JANUARY, 1951

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION

Piping and Pumps in Power House at a Ford Plant

Detroit's Ideal Home Heating System . . . . page 55

Selection of Air Filters . page 58

Cast Iron Fitting Allowances . page 66

Tables for Radiant Heating Design . . . . page 71

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Start with Ric-wiL Insulated Piping

● Ric-wiL Prefabricated Insulated Piping occupies a key position in the planning and production of efficient insulated piping in central heating or air conditioning systems for multiple building projects.

Experienced architects, engineers and contractors recognize Ric-wiL systems as the practical answer for exposed or underground insulated piping. They are custom engineered and prefabricated of the finest materials for quick economical installation, efficient performance, and long maintenance-free life.

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Call the Ric-wiL office nearest you and our representative will be glad to give you detailed technical information as related to your specific problem.

For full technical information on Ric-wiL Insulated Piping Systems, call or write the Ric-wiL office nearest you or Dept. 2-N in Cleveland, Ohio.

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INSULATED PIPING SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, O.

OVERHEAD • UNDERGROUND

FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS

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REFRIGERATION helps you serve better

There are just two steps to closing more business

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Company

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City and State

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...a size and type for every purpose

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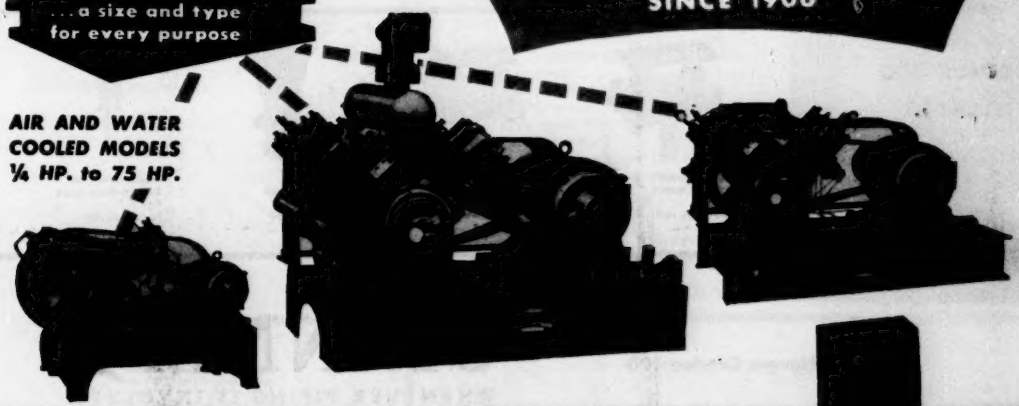
AIR AND WATER COOLED MODELS
¼ HP. to 75 HP.

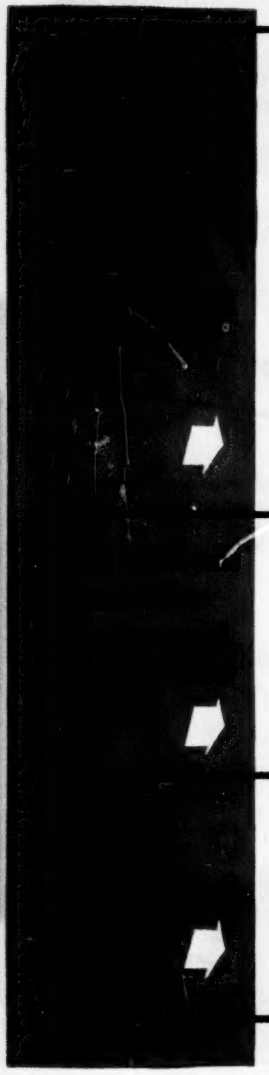


BRUNNER SINCE 1906

AIR CONDITIONING
Self Contained Units in 4 sizes: 3-5-7½ and 10 HP.
Remote Installation Types from 3 to 75 HP.

ADJUSTABLE PIPE HANGERS AND SUPPORTS

for every piping requirement



I-Beam Clamp
fig. 131
for 2 to 6-in. flange

Center I-Beam Clamp
fig. 217
safe load: 150 lb

Simplex Top Beam Clamp
fig. 267 — safe load: 150 to 2300 lb

Swinging Top Beam Clamp
fig. 270 — safe load: 150 to 2300 lb

Universal Channel Clamp
fig. 226 — safe load: 150 to 2300 lb

Channel Extension Clamp
fig. 219
safe load: 150 lb

Simplex Channel Clamp
fig. 266 — safe load: 150 to 2300 lb

Universal Side I-Beam Clamp
fig. 225 — safe load: 150 to 2300 lb

Simplex Side I-Beam Clamp
fig. 265 — safe load: 150 to 2300 lb

C-Clamp
fig. 88
⅜ to ¾-in. rod.

UFS W-F I-Beam Clamp With Links and Weldless Eye Nut — fig. 293
safe loads: up to 11,500 lb

UFS I-Beam Clamp with Weldless Eye Nut
fig. 292 — safe loads: up to 11,500 lb

UFS W-F I-Beam Clamp With Links
fig. 294 — safe loads: up to 11,500 lb

UFS I-Beam Clamp
fig. 228 — safe loads: up to 11,500 lb

C-B Universal Concrete Insert
fig. 282
⅜ to ⅝-in. rod

C-B Junior Concrete Insert
fig. 279
⅜ to ⅝-in. rod

Screw Concrete Insert
fig. 151
⅜ to ⅝-in. rod

Expansion Case Closed Back Type
fig. 117
¼ to 1-in. rod

Write for Hanger Catalog 10D

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HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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The contents of HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and by Engineering Index.

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PUBLISHERS OF MACHINERY & MACHINERY'S HANDBOOK
The INDUSTRIAL PRESS

THIS MONTH'S COVER

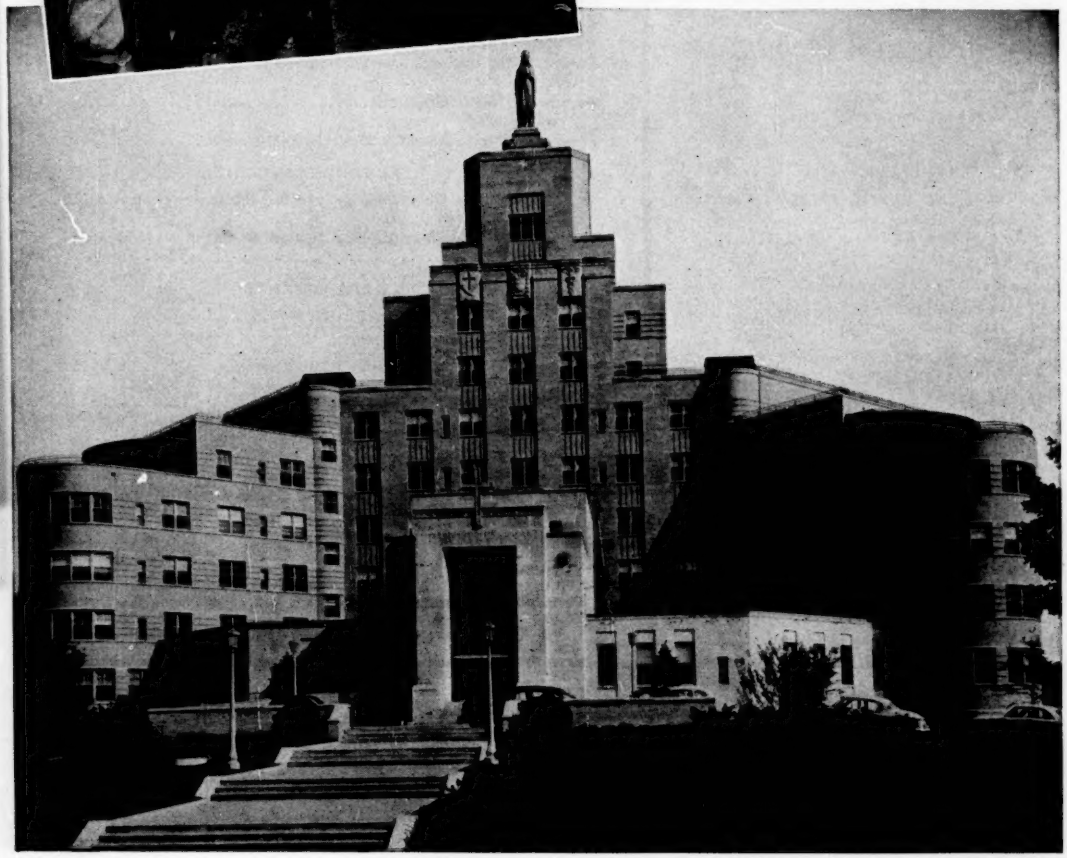
Front cover photograph shows piping and pumping arrangement in a Ford Motor Co. power house. Photo is by Albert Kahn Associated Architects and Engineers.

Heating a great

The formal opening of Our Lady of Lourdes Hospital on July 1, 1950, signalized the completion of a $4 million project which is the last word in hospital construction and equipment.

Steam was selected for the heating of this great institution—steam harnessed and brought under control with a Webster Moderator System of Steam Heating. An Outdoor Thermostat adjusts the supply of steam with every change in temperature. Prevents wasteful overheating. Maintains comfort conditions during mild weather or on the severest winter day.

Our Lady of Lourdes Hospital, Camden, N. J.
At left: corner of a typical semi-private room.



New Hospital

Webster System Radiators, taking no useable room space, were engineered into sanitary enclosures integrated with the window construction. Metal front provides easy access if necessary. Each convector has a built-in radiator trap and valve, permitting 100% heat shut-off—no dampers are needed.

Operation of the institution is under the direction of the Sisters of the Third Order Regular of St. Francis. Included in the Hospital is the Bishop's suite and a chapel seating 250.

An important factor in the success of Webster Heating installations is the friendly service and close cooperation of the authorized Webster Factory Representative. Call him or write us for his name. **Address Dept. HV-1**

WARREN WEBSTER & CO., Camden 5, N. J.
Representatives in Principal Cities
In Canada, Darling Brothers, Limited, Montreal.

WEBSTER
MODERATOR
SYSTEM
OF STEAM HEATING
"Controlled by the weather"

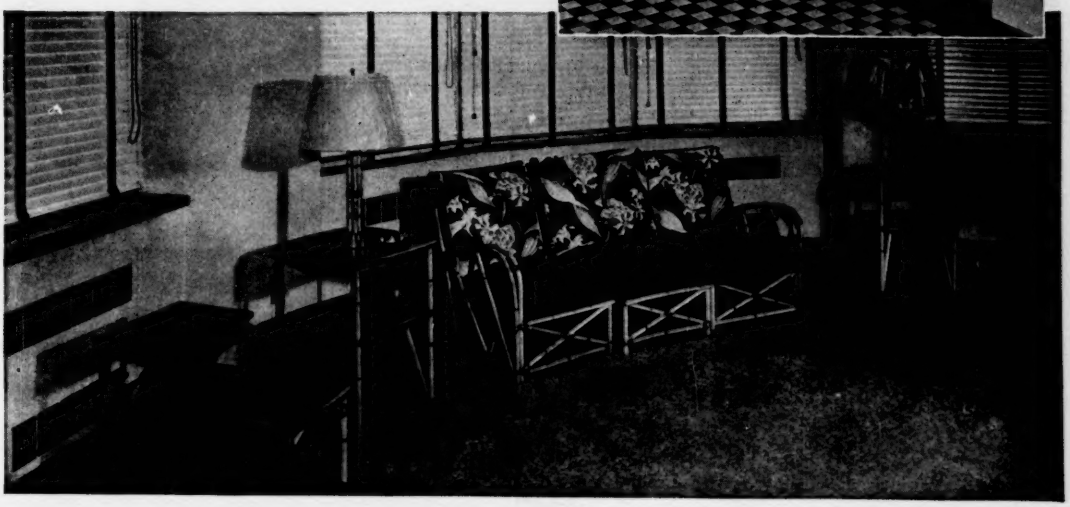
Architect:
Paul C. Reilly, New York.

Builder:
George A. Fuller Company, New York.

Consulting Engineer:
Sears & Kopf, New York.

Heating Contractor:
Daniel J. Keating Co., Philadelphia.

Chief Engineer A. D. Bradley uses master key for heat shut-off at individual radiators. Shown at bottom of page is one of 14 solariums.



No other air handling unit

CAN MATCH ALL THESE

Westinghouse Air Handling Units have rolled up new performance records under exacting conditions in the field. Superior, rugged construction and sound engineering have brought them wide acceptance in a short time. What's behind this record . . .

1. CONSTRUCTION

Sectionalized casings have welded, gusseted structural angle frames and removable panels. Fan and coil section panels have half-inch rigid internal insulation. Rotating parts—wheels, shafts and bearings—are heavy and rugged. Result—Non-distortion in shipping, easier assembly, smooth operation, better appearance, and lower maintenance costs.

2. FLEXIBILITY

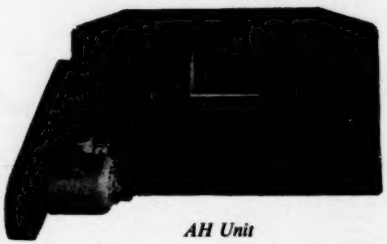
Westinghouse sectionally-designed components—fans, heating and cooling coils, filters, mixing boxes, bases and drains—can be assembled for any air handling operation, vertical or horizontal. Result—Installations "tailor-made" to particular job requirements.

3. PERFORMANCE

Backwardly inclined Silentvane fan wheels mean stable air flow and silent operation. Non-overloading horsepower and steep, stable pressure characteristics eliminate pulsing and surging. Result—Long, trouble-free service.

Behind these important features is the UNDIVIDED RESPONSIBILITY of Westinghouse for *every* major part. No other manufacturer today offers this "plus" value. For complete information on Westinghouse Air Handling Units—Type AH (Horizontal) or Type AV (Vertical)—write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

See our Exhibit, Booth 507 International Heating & Ventileting Exposition at Philadelphia, January 22-26, 1951



AH Unit

FEATURES

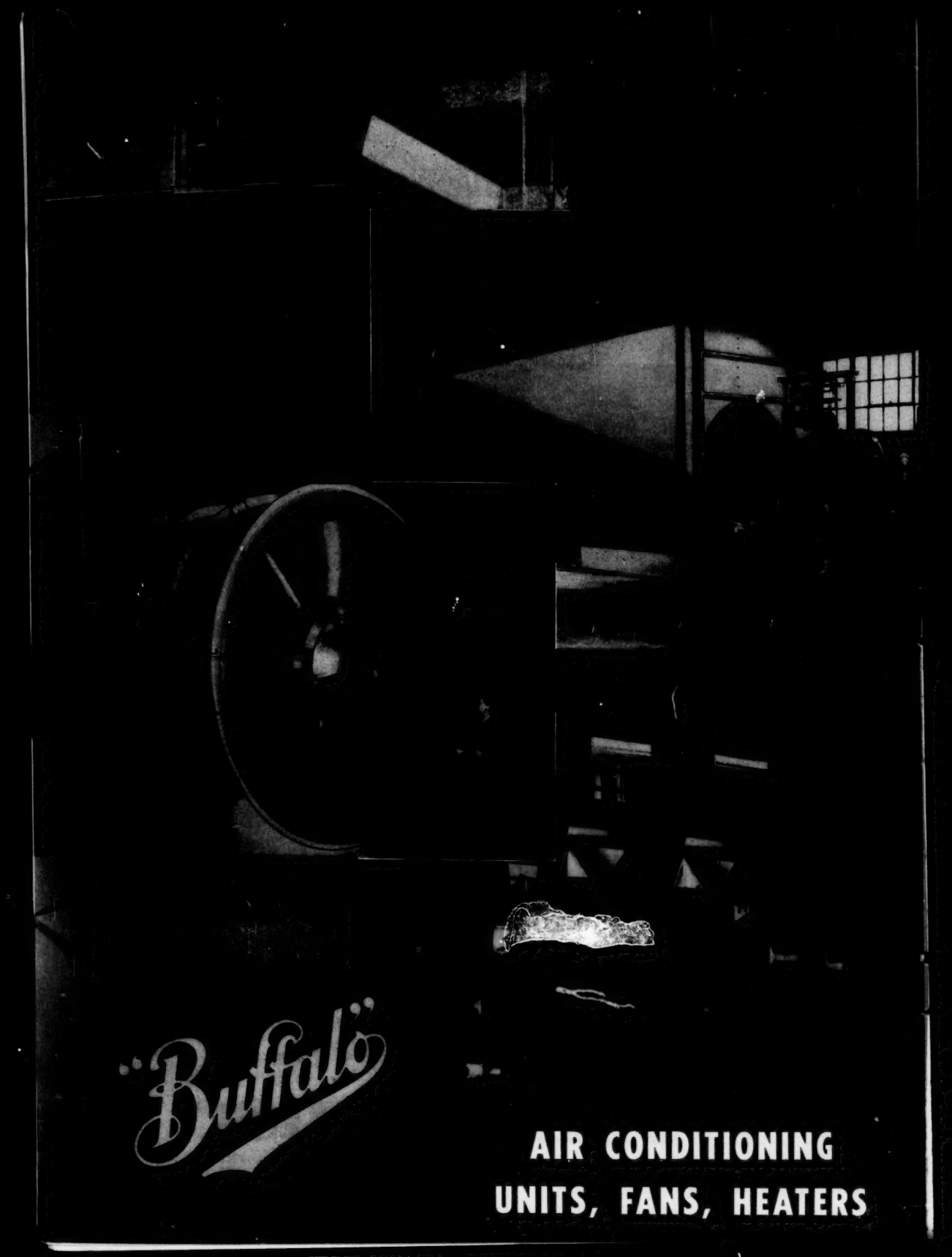
AV Unit

AH fan section being assembled

YOU CAN BE SURE...IF IT'S

Westinghouse

J-80191A


"Buffalo"
AIR CONDITIONING
UNITS, FANS, HEATERS

See us at Philly...

WE have something new to show you!

We can't tell you about it here, but if you're interested in air moving equipment — you'll want to see it!

In addition, of course, we'll show some of our latest air conditioning and heating apparatus, the husky, heavy-duty equipment that has made friends for "Buffalo" for seventy-three years.

If you're at the 10th International Heating & Ventilating Exposition, we'll be looking for you at space 79.

Write for any of the bulletins shown at left if you do not have them — they contain ratings and engineering data on four outstanding values:

Bulletin 3158-B	Buffalo Air Conditioning Cabinets
Bulletin 3675	Buffalo "LL" Ventilating Fans
Bulletin 3533-D	Buffalo Axial Flow Fans
Bulletin 3704	Buffalo Highboy Heaters

BUFFALO FORGE COMPANY

BROADWAY BUFFALO, N. Y.

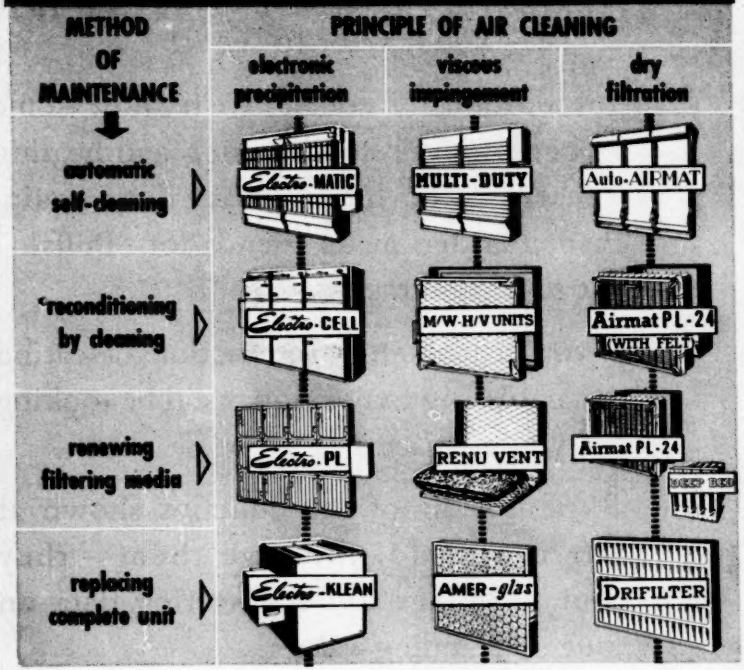
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

AAF AIR

World's Greatest and Only Complete Line of Air Filtration and Dust Control Equipment

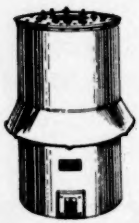
The AAF Line of *Engineered* Air Filters



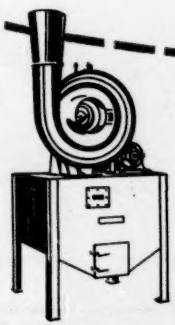
Greater emphasis on selecting the right air cleaner for a specific job has given new importance to American Air Filter's complete line. You see left, for example, twelve distinct types of AAF filters and electronic precipitators charted according to air cleaning principle and method of maintenance. These AAF products offer a wide selection of performance and operating characteristics to meet practically every air cleaning need.

Because of this complete line AAF engineers are not biased by a single type or design and can therefore recommend the filter best suited to the job.

Cycoil ENGINE AND COMPRESSOR FILTERS . . . AAF's Oil Bath Cleaner. Engineered to deliver practically 100% cleaning efficiency, this heavy-duty cleaner protects engines and compressors under conditions of severe dust and dirt. Over 90% of fine dust content in air is trapped in oil, then removed by centrifugal action, before reaching the filter. Added filtering action from filter pads, plus positive oil circulation which produces a self-cleaning action and great dust-holding capacity offers maximum air cleaning results.



ROTO-CLONE DUST CONTROL . . . AAF's line of dynamic and hydrostatic precipitators perform the functions of exhausting, separating and storing the dust in a single compact unit. Available in three distinct types and a complete range of sizes. Preferred throughout industry for simplicity, low operation cost, extreme compactness and maximum efficiency.

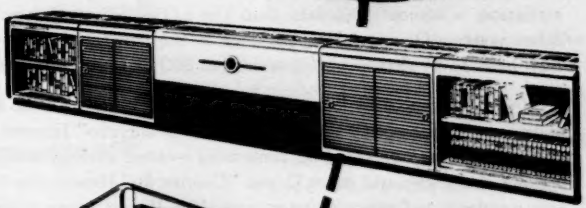


HEADQUARTERS

herman nelson

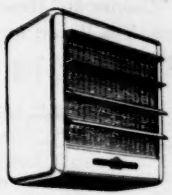
Unsurpassed Quality for Modern Heating and Ventilating Products

Superiority of engineered features has established records for trouble-free service and low operating cost of Herman Nelson products. The way to be certain of getting the latest refinements in heating and ventilating is to specify and buy Herman Nelson . . . *the constantly-improved line.*



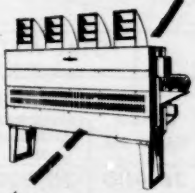
DRAFT | STOP UNIT VENTILATOR

Here is a 1951 innovation for school classrooms. It is the ONLY system of ventilation that traps drafts at the source, makes use of such air motion in controlling introduction of fresh air into rooms, automatically maintaining a healthful, comfortable temperature.



UNIT HEATERS

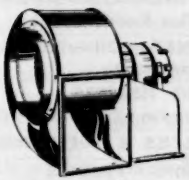
A complete line of unit heaters including horizontal and vertical propeller-fan type, de luxe, and centrifugal fan-type units. A model and size for every steam or hot water application—request detailed performance data.



PROPELLER FANS—UNIT BLOWERS

Long service of Herman Nelson propeller fans can be attributed to the quality of material and simplicity of design. Fan blades with "air foil" profile produce maximum air delivery . . . efficiently and quietly.

Whatever your requirements for large volume air delivery, there's a size and type of Herman Nelson Unit Blower to serve you. A national field organization assures rapid service. Request complete range of sizes.



AAF

herman nelson

TODAY'S BEST BUY IS BETTER AIR

American Air Filter

COMPANY INC.,

HERMAN NELSON DIVISION

PLANTS: LOUISVILLE, KENTUCKY MOLINE, ILLINOIS

DRAVO HEATERS..

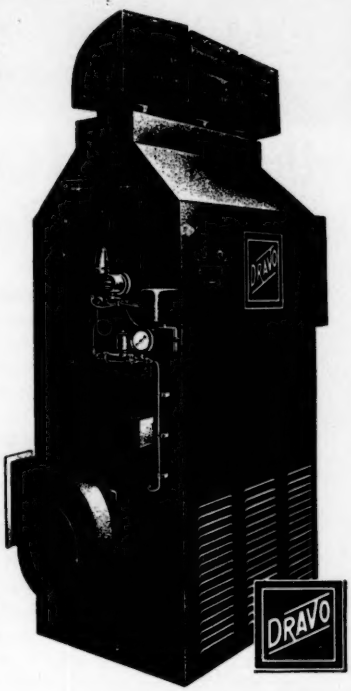
AS WELL AS MONEY....FUEL...

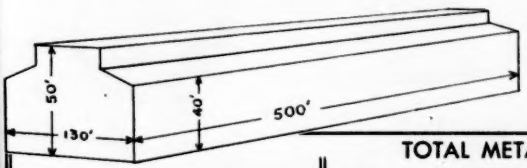
Heating system steel needs *can* be slashed from 50% to 70% for the representative open-space industrial structure shown below . . . by using the direct-fired warm air heating method with Dravo "Counterflo" Heaters! This conservation, of vital importance today, adds another to the long list of economies in money, fuel and labor effected by this heating method.

The chart below gives the detailed comparative story. Every system is equivalent in Btu output. Steel requirements for the 13 methods have been carefully and conservatively calculated.

It will be noted that Dravo Heaters not only take LESS steel in each fuel classification . . . but that the HIGHEST steel requirement in a Dravo installation is almost 50% less than the LOWEST steel requirement in any other system. Of special significance is the contrast in *pipe* required. Jobs now held up by slow pipe deliveries can MOVE . . . if Dravo Heaters are used!

Any time that YOUR jobs are delayed or deferred because of steel or pipe shortages, why not find out how Dravo "Counterflo" Heaters are expediting things for other users? And remember — steel savings are just *one* of the reasons that more and more Dravo "Counterflo" Heaters are heating increasing numbers and types of structures. You'll find many other good reasons listed at right, that will appeal to you.





Each heating system compared below was sized to make up a calculated 12,000,000 Btu heat loss in this representative industrial building.

TOTAL METAL REQUIREMENTS FOR VARIOUS HEATING SYSTEMS

COMPONENT	GAS FIRED					OIL	
	DRAVO WARM AIR	HIGH PRESSURE CONVENTIONAL WATER TUBE BOILER	HIGH PRESSURE PACKAGED STEAM GENERATOR	LOW PRESSURE CONVENTIONAL WATER TUBE BOILER	LOW PRESSURE PACKAGED STEAM GENERATOR	DRAVO WARM AIR	HIGH PRESSURE CONVENTIONAL WATER TUBE BOILER
BASIC HEAT GENERATORS	26,400	38,000	62,000	38,000	62,000	26,400	38,000
PIPING—Oil—Steam Boiler Room—Gas	9,096	15,490	15,490	35,308	35,308	4,352	15,790
TANKS—Oil—Blow-off Condensate		3,500	1,500	1,500	1,500	13,000	16,500
UNIT HEATERS including Traps & Starters		21,240	21,240	21,240	21,240		21,240
STACKS & BREECHING	1,200	4,000	400	4,000	400	1,200	4,000
PUMPS—Fuel Oil Auxiliary Oil—Boiler Feed		1,000	1,000	1,000	1,000	400	1,400
STOKERS & FANS— including Dust Collectors Fuel Oil Preheaters							2,000
STRUCTURAL STEEL Boiler House Foundation Reinforcing		7,000	2,000	7,000			7,000
TONS of STEEL REQUIRED	DRAVO **18**	**45**	**52**	**54**	**61**	DRAVO **23**	**53**

..CONSERVE STEEL

. AND MAN HOURS

DISTRIBUTION PIPING AND DIFFUSERS COMPLETELY ELIMINATED

LEAST STEEL PER 1,000,000 BTU OUTPUT

NO VALVES, TRAPS OR FITTINGS

STAINLESS STEEL CHAMBER ELIMINATES REPLACEMENT

DRAVO CORPORATION

HEATING DEPT., DRAVO BUILDING, PITTSBURGH 22, PA.
Sales Representatives in Principal Cities.
Mfd. and Sold in Canada by Marine Industries, Ltd., Sorel, Quebec.

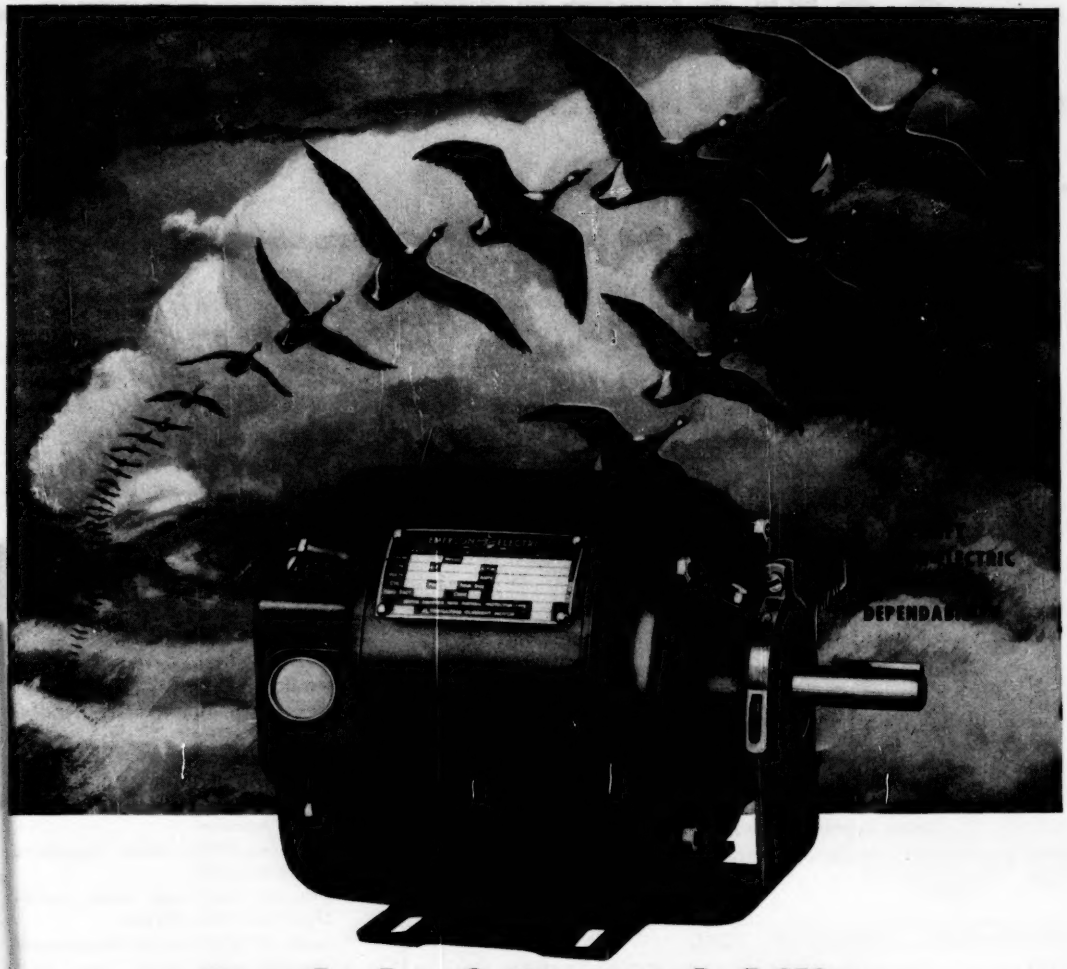
WITH IDENTICAL 12,000,000 Btu LOAD

FIRED →				← COAL FIRED	
HIGH PRESSURE PACKAGED STEAM GENERATOR	LOW PRESSURE CONVENTIONAL WATER TUBE BOILER	LOW PRESSURE PACKAGED STEAM GENERATOR	DRAVO WARM AIR	HIGH PRESSURE CONVENTIONAL WATER TUBE BOILER	LOW PRESSURE CONVENTIONAL WATER TUBE BOILER
62,000	38,000	62,000	27,450	38,000	38,000
15,790	35,608	35,608		14,990	34,808
14,500	14,500	14,500		3,500	1,500
21,240	21,240	21,240		21,240	21,240
400	4,000	400	1,200	4,000	4,000
1,000	1,400	1,000		1,000	1,000
	2,000		23,850	15,000	15,000
2,000	7,000			7,000	7,000
58	**62**	**67**	DRAVO **26**	**52**	**61**

DRAVO HEATERS HAVE EARNED HIGHEST ACCEPTANCE BECAUSE THEY

- *use less steel*
- *eliminate distribution piping*
- *have lower initial cost*
- *are very efficient in fuel consumption*
- *concentrate comfort heat at the working level*
- *reduce roof heat losses*
- *burn gas or oil*
- *are available in coal burning models*
- *save man hours through automatic operation*
- *require no attendant and negligible maintenance*
- *produce heat instantly and ONLY when needed*
- *have stainless steel chambers for longer life*
- *prevent rust and stain conditions in metal storage*
- *bear UL label and AGA approval*
- *require only stack, fuel and power line*
- *are portable and readily moved*
- *provide year 'round ventilation*
- *are ideal for process drying*
- *avoid freeze up worries, leaky traps, valves, etc.*
- *are shipped complete and flame tested*
- *can be installed on floor, wall or roof*
- *can be mounted upside down or horizontally*
- *eliminate ductwork with 150 ft. air throw*

WRITE TODAY FOR BULLETIN HI—523—809



Symbol of Dependability

Write for these Emerson-Electric Motor Data Bulletins

Appliance and equipment manufacturers, with applications for motors of 1/20 to 5 h.p., can profitably use these authoritative reference guides. Specifications, construction details and performance data are included for the following types:

- ☐ No. 103-A Capacitor-Start Motors
- ☐ No. 103-B Split-Phase Motors
- ☐ No. 103-C Integral Motors
- ☐ No. 103-D Fan-Duty Motors
- ☐ No. 103-E Oil-Burner Motors
- ☐ No. 103-F Jet Pump Motors
- ☐ No. 103-G Blower Motors

In earning a reputation for dependable performance there is also the opportunity to demonstrate leadership. Only a very few accept the challenge. You can point out one or two leaders, in every line of manufacture, whose success resulted from their products having become symbols of dependability.

Scores of America's best known manufacturers depend on Emerson-Electric motors to power their products. They know that customer satisfaction and dependable performance go hand in hand.

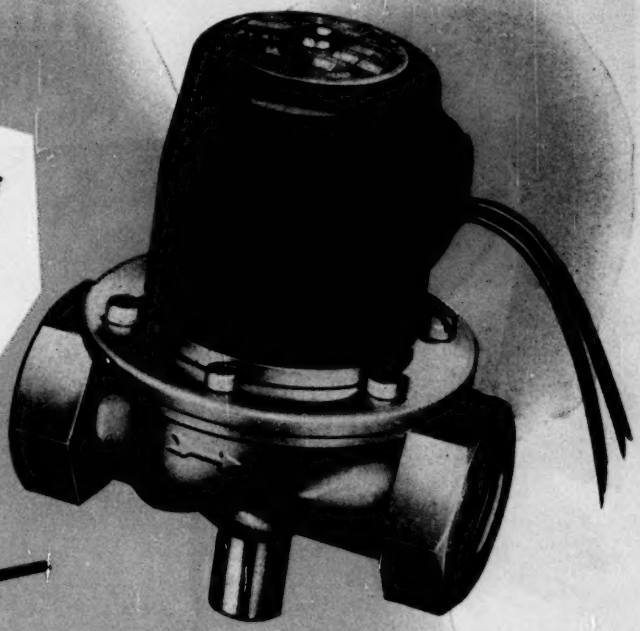
A background of 61 years of motor manufacturing experience stands behind Emerson-Electric motor design and production, offering the right motor for every job, in ratings from 1/20 to 5 h.p.

Consider the advantages of Emerson-Electric motors when planning your long-range program for top-flight leadership ratings on your equipment. Send for complete literature today.

THE EMERSON ELECTRIC MFG. CO.
ST. LOUIS 21, MO.

EMERSON Emerson Electric **ELECTRIC**
MOTORS • FANS APPLIANCES

demand DETROIT CERTIFIED CONTROLS



DETROIT NO. V-541 MAGNETIC GAS VALVE

Large gas capacity and low pressure drop • Tight seating eliminates leakage—no flashbacks • Absolutely quiet operation • Plunger seal prevents sticking • Spring action plunger provides smooth opening and long plunger life • Kick-off spring eliminates plunger "hang-up" • Easily installed and serviced.

Voltages: 24 volts, 60 cycles; 115 volts, 60 cycles. Sizes: ⅜" through 1". Can be used with either natural gas, L. P. or L. P. air mixtures.

Introducing

THE NEWEST ADDITION TO A QUALITY LINE!

Here's brand new evidence of what most heating men have known for years—it pays to demand DETROIT! Why? Because DETROIT Certified Controls are designed and built with one purpose in mind...to make any heating unit better! And one sure way to make gas heating units better is to install DETROIT'S new V-541 Magnetic Gas Valve. Having many new and outstanding features, the V-541 is a truly significant advance in solenoid valve design and is engineered for use on a wide variety of gas fired units. So insist that your source of supply furnish DETROIT Certified Controls with all your heating equipment. We guarantee you'll be doing yourself *and* your customers a lasting favor! For further facts, write for Bulletin No. 234.

Visit our display in Booth No. 734 at the 10th Annual International Heating and Ventilating Exposition, January 22nd—26th, Philadelphia, Pennsylvania.

DETROIT
LUBRICATOR COMPANY

5900 TRUMBULL AVE., DETROIT 8, MICHIGAN
Division of American Radiator & Standard Sanitary corporation
Canadian Representatives: RAILWAY & ENGINEERING SPECIALTIES, LTD.—Montreal, Toronto, Winnipeg

DETROIT HEATING AND REFRIGERATION CONTROLS • BURNER SAFETY CONTROLS • FLOAT VALVES AND OIL BURNER EQUIPMENT • DETROIT EXPANSION VALVES AND REFRIGERATION ACCESSORIES • STATIONARY AND LOCOMOTIVE LUBRICATORS

Serving home and industry

Depend on FAR-AIR* for better air filtration . . .

Specify FAR-AIR Filters like this:

"Filters shall be permanent, impingement, washable, all metal, panel type. Media shall be zinc electroplated, 14 mesh steel screen, arranged in alternate layers of flat and herringbone-crimped screens, 4 layers of each per inch, rod reinforced, and enclosed in a frame of 16 ga. steel with flush mitered corners. Resistance to air flow of a clean filter shall not exceed 0.12" wg at 3.6 cfm per square inch of net face area.

"Holding frames shall be factory built of 16 ga. steel "T" section, bonderized and bake enameled, with felt air seal, interlocking edges, and filter locking device.

"Filters shall be FAR-AIR Type 44 and frames shall be FAR-AIR Standard Interlocking as manufactured by Farr Company, Los Angeles 43, California.

Your air conditioning system depends on proper air filters for its efficient operation and long service life, yet the air filters account for only a small percentage of the entire system's total cost. FAR-AIR filters cost a little more than ordinary types but they are worth far more than they cost because *they have no equal* in efficiency, dirt-holding capacity, ease of cleaning and quality of construction.

Install Far-Air Filters now and take advantage of their over-all economy while enjoying better air filtration. Write for complete information.

Users of FAR-AIR Filters include:

Carnation Co. • Eastman Kodak Co.
Westinghouse Electric Corp.
Monsanto Chemical Co.
Wm. Wrigley, Jr. Co.

*Trade Mark Reg.

FAR-AIR FILTERS

"Better by Farr"

FARR COMPANY

Manufacturing Engineers

Los Angeles • Chicago • New York

M'f'd under license by Control Equipment Co., Ltd., Montreal, Canada

TRANE

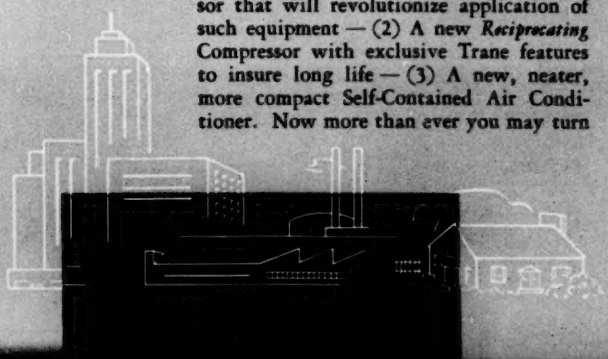
3 GREAT NEW TRANE AIR CONDITIONING PRODUCTS

For a quarter-century, The Trane Company has devoted its design ability and manufacturing skill to building an ever-increasing selection of component parts — from which could be assembled the very best engineered heating and air conditioning systems.

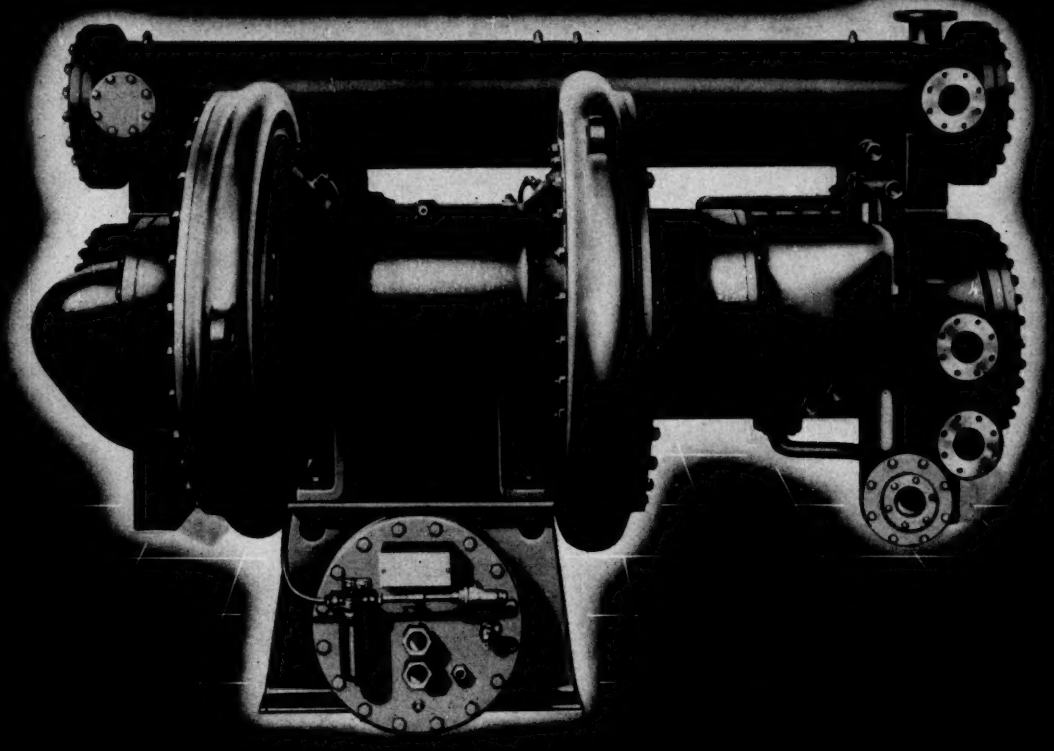
Now Trane announces three great new products — (1) A new *Centrifugal* Compressor that will revolutionize application of such equipment — (2) A new *Reciprocating* Compressor with exclusive Trane features to insure long life — (3) A new, neater, more compact Self-Contained Air Conditioner. Now more than ever you may turn to one completely reliable source to provide you with:

1. Undivided responsibility for performance of your entire system.
2. Essential parts designed, manufactured, and tested together for use together.
3. Selection from one set of catalogs, using uniform ratings.
4. Convenience: basic products are ordered together and shipped together.

Read the engineering facts about the two all-new Trane Compressors, and the new Trane Self-Contained Air Conditioner on the next few pages.



• *See these and other new products in the giant Trane show at the 10th International Air Conditioning Exposition in Philadelphia, January 22-26.*



TRANE

New CENTRAVAC – Only Centrifugal in 45-150 Ton Range

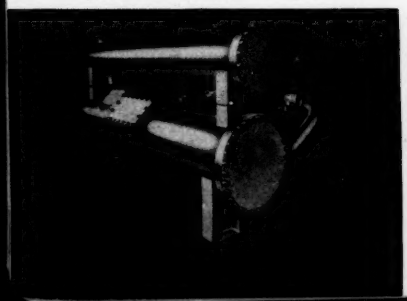
The new Trane Centravac is destined to make refrigeration history with its two revolutionary developments. First, it is the only Centrifugal available in the 45 to 150 ton range. Second, Trane engineers have created a Centrifugal in which power reduction is greater than capacity reduction over wide operating ranges. Now the Centrifugal Compressor can be used to furnish chilled water for installations as low as 45 tons. In addition to power economies, the capacity control in the Centravac insures economical and stable machine operation from 100% down to 20% — the conditions encountered in normal air conditioning application.

Centrifugal refrigeration is, for the first time, made available for the smaller installation and with the greatest possible economy — truly a great refrigeration development.

The impellers of the new Centravac are mounted directly on the shaft of a water-cooled motor. This motor is hermetically enclosed in the machine, hence seals and gear boxes, with all their problems of maintenance and service, are completely eliminated. Because of this construction, only two bearings are used in the entire system. Improved lubrication is obtained by a positive displacement oil pump.

Installation is easy. Because the Centravac is compact, light weight and operates quietly and without vibration, it can be mounted anywhere in the building. Refrigerant used in the Centravac is Freon-113, nontoxic, noninflammable. Available in five sizes from 45 to 190 tons.

Rear view of new centrifugal compressor showing clean cut design.



Radial blade cast impeller with high efficiency.

Variable inlet vane assembly provides the ultimate in capacity control.

TRANE

New, Smaller Compressor Has Bigger Capacity—Longer Life

Over-all size of the new Trane Reciprocating Compressor is no bigger than the motor required to run it. Greater capacity has been packed into this smaller direct driven unit.

Exclusive Trane features make the new Compressor last longer. Valve life has been increased 900%. Valves, in test units, needed no attention after the equivalent of 7 seasons of continuous operation.

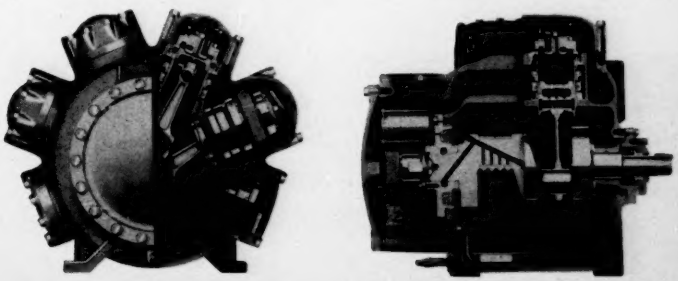
The Trane Compressor starts unloaded because of an entirely new oil pressure activated mechanism. Designed to use a standard, general purpose motor. A newly developed capacity control system adjusts capacity to demands of the cooling system through three stages of reduced load operation.

Forced feed, automotive type oil system assures positive lubrication. Aluminum pistons and connecting rods reduce moving weight. Safety head design reduces hazards of liquid slugging. Contact the nearest Trane Sales Office for more information.

COMPARE THESE TRANE RECIPROCATING COMPRESSOR FEATURES

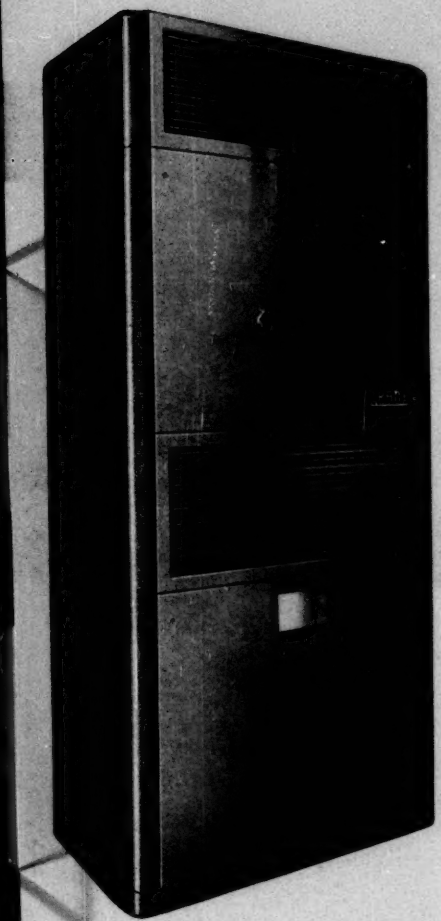
1. Outstanding capacity control over a wide range of operating conditions.
2. Entirely new design incorporating the latest developments in refrigeration practice.
3. Engineered especially for air conditioning.
4. Lower operating costs thanks to higher efficiency over wider ranges.
5. Forced feed positive type lubrication to protect vital moving parts.
6. Smoother operation due to careful balancing in design and manufacture.
7. Completely Trane engineered and Trane built.

Cutaway front and side view of 8-cylinder model, showing essential parts in a minimum of space.



New self-contained air conditioner sets new records in EFFICIENCY, ECONOMY, VALUE

Out of the ever-continuing Trane development program has emerged this highest-quality self-contained air conditioning unit. Here is a sturdier machine that occupies a minimum of floor space. Available in sizes down to 3 tons capacity. In every size there is extra quality at competitive prices.



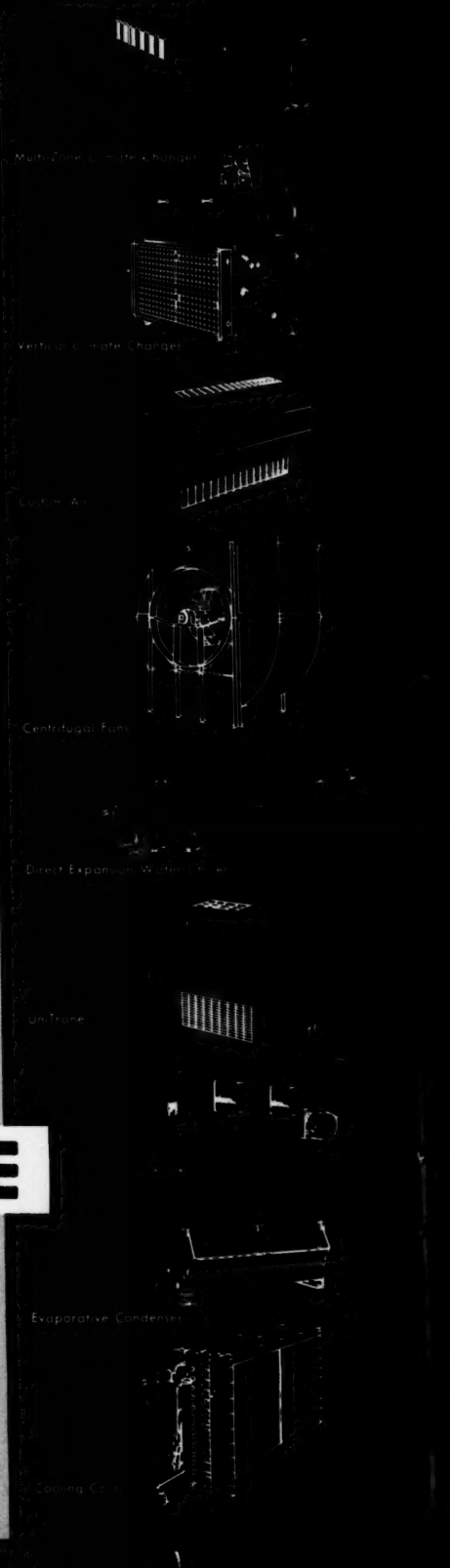
Featured is a completely accessible hermetic compressor, the famous Trane Cooling Coil, thorough vibration elimination, panels insulated with fireproof fiber glass, two-directional outlet grills, quiet operation. Cam locked front panels are easily removed for easy servicing and maintenance. Optional discharge chamber with heating coil, if desired.

Shipped ready-to-run after 3 simple connections for water, electricity and drainage.

Designed for beauty as well as years of service, these new Trane units assure comfort and satisfaction on any job where a self-contained air conditioner is practical or desirable.

Your Trane Representative is ready with complete information about this new air conditioner. He can tell you also how the new Trane Compressors can be used with other Trane Cooling Equipment to create complete systems for better air conditioning.

8 basic products by Trane, designed and built together for use together in complete air conditioning systems



TRANE

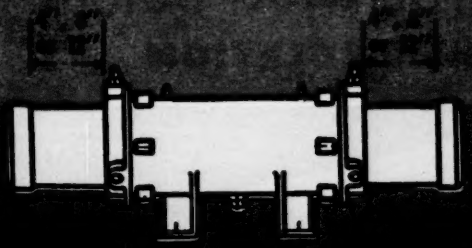
THE TRANE COMPANY, LA CROSSE, WISCONSIN
EASTERN MANUFACTURING DIVISION, SCRANTON, PENNSYLVANIA

Manufacturing Engineers of Heating, Ventilating, and Air Conditioning Equipment • Unit Heaters, Convectors, Heating and Cooling Coils, Fans, Compressors, Air Conditioners, Unit Ventilators, Special Heat Exchange Equipment, Steam and Hot Water Heating Specialties

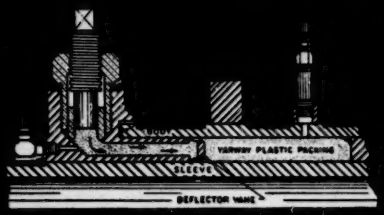
. . . IN CANADA, TRANE COMPANY OF CANADA, LTD., TORONTO

PRINTED IN U.S.A. 2004-195-1250 J&K

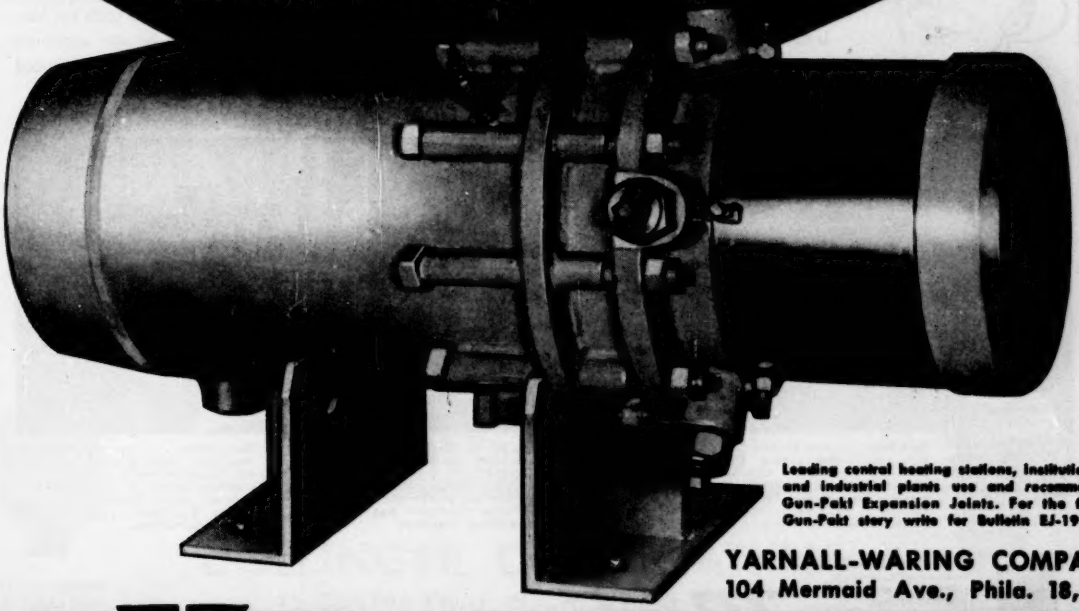
YOU NEED FEWER JOINTS



AND LESS MAINTENANCE



W... GUN-PAKT ...ints



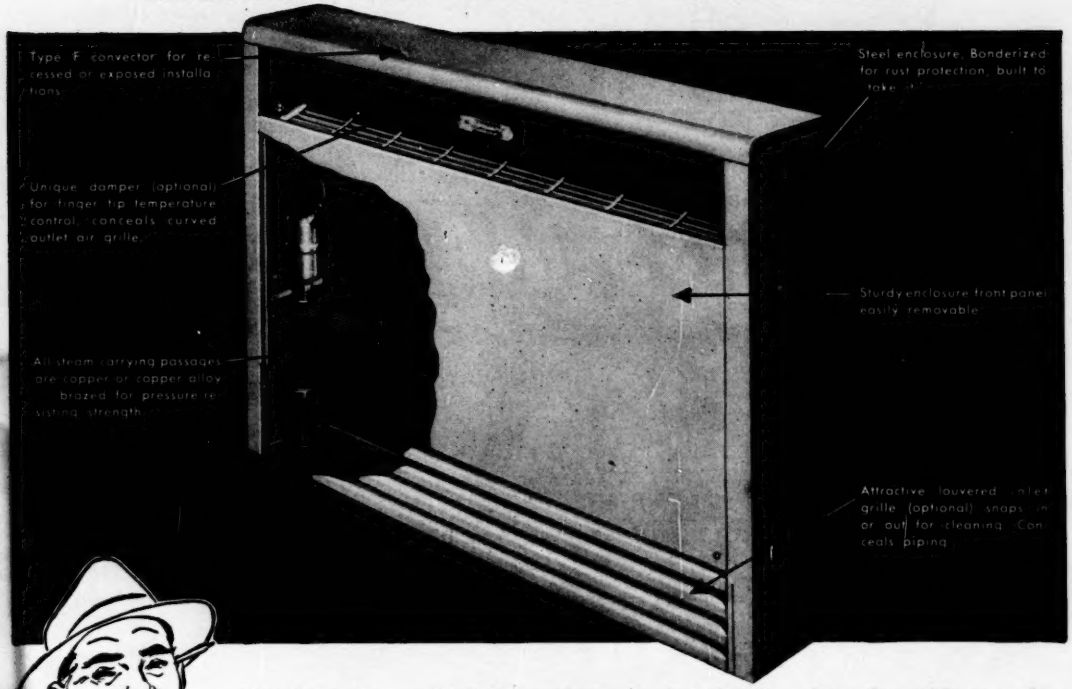
Leading central heating stations, institutions and industrial plants use and recommend Gun-Pakt Expansion Joints. For the full Gun-Pakt story write for Bulletin EJ-1912.

YARNALL-WARING COMPANY
104 Mermaid Ave., Phila. 18, Pa.

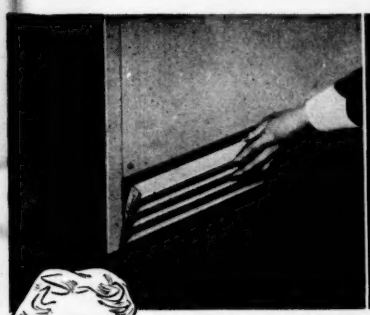
YARWAY GUN-PAKT EXPANSION JOINT

Everybody's happy when you select

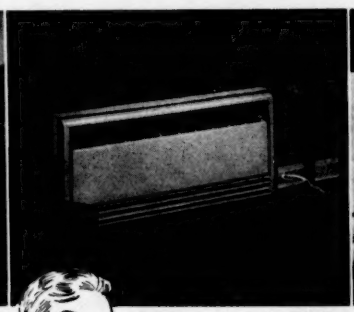
MODINE CONVECTOR RADIATION


Type F convector for recessed or exposed installations
Unique damper (optional) for finger tip temperature control, conceals curved outlet air grille
All steam carrying passages are copper or copper alloy brazed for pressure resisting strength
Steel enclosure, Bonderized for rust protection, built to take it
Sturdy enclosure front panel easily removable
Attractive louvered inlet grille (optional) snaps in or out for cleaning. Conceals piping

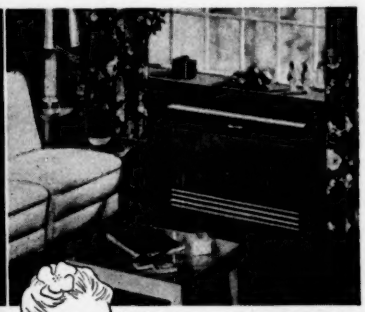
He's happy because Modine Convectors are easier to install . . . time and material costs are less. Individually cartoned, they weigh only ¼ as much as cast iron radiators. Square enclosure corners simplify recessing. Universal headers and adjustable-pitch heating unit brackets speed piping connections. On any type or size of job, he profits most when he installs Modines.



She's happy because Modine Convectors are so easy to clean. Dust can't get a foothold! Optional snap-in lower grille instantly removable for cleaning. For major seasonal sprucing up, front panel can be removed in a jiffy.



He's happy he specified Modine. Giving his client the benefit of blended radiant and convection heat plus the beauty, convenience, durability and proved economy of Modine Convectors was a case of excellent judgment.



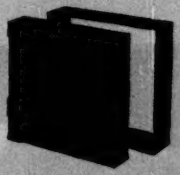
She's happy . . . as any decorator would be . . . when Modines are selected. Their functional styling permits complete freedom of room treatment. Recessed under windows, Modines use no floor space . . . are never a decorative problem.

R-1086

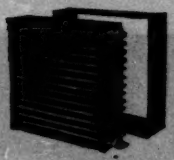
For new catalog, call your Modine representative --listed in your phone book classified section. Or write Modine Mfg. Co., 1511 Dekoven Ave., Racine, Wisconsin.

Modine CONVECTOR RADIATION

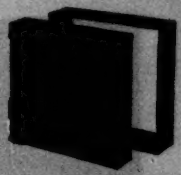
Model A-3
(Automatic)
Ventilation Filter



Models DPV and PVG
(Viscous Panel)
Ventilation Filter



Model WKE-S
(Dry Panel)
Ventilation Filter



Models WKE-2 and -4
(Dry Panel)
Ventilation Filter

Model IDR
(Ground Level)
Air Intake Filter

YOU ARE

Cordially Invited

TO INSPECT THE COMPLETE LINE OF

Staynew

FILTERS

BOOTH 408

INTERNATIONAL

HEATING & VENTILATING EXPOSITION

JANUARY 22-26

PHILADELPHIA, PA.

Model SE (Sump)
Liquid Filter

Model DS (Silencer)
Air Intake Filter

Model ELS (Pressure)
Liquid Filter

Model D (Outdoor)
Air Intake Filter

Model CFH
Pipeline Filter

DOLLINGER
REG. PROTECTOMOTOR U.S. PAT. OFF.
STAYNEW FILTERS

Model C (Indoor)
Air Intake Filter

Model CVH (Vacuum)
Pipeline Filter

DOLLINGER CORPORATION

15 CENTRE PK. • ROCHESTER 3, N. Y.

247,500 SQ. FEET AREA FOR CARRIER

Structural Design by Lockwood Greene & Co., New York, Architects & Engineers

Heating Designed and Installed by Carrier Corporation.

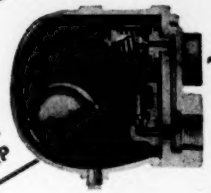
The engineers who designed the new Carrier Plant at Syracuse, New York, didn't just call up somebody and say "send us some steam traps." For they are the men who know air conditioning and heating, and the savings or losses that may be built into a plant when selecting the steam accessories.

So this Plant is ALL-SARCO—with the well known Sarco float-thermostatic steam traps for heating coils and Sarco bucket traps for the unit heaters.

And for permanent insurance against failures due to foreign material in their steam and water lines, more than 100 Sarco strainers ranging in sizes from ¾" to 3" are inserted at vital points all over the plant.

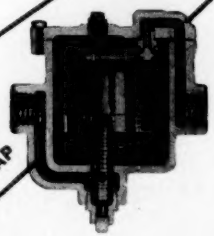
Sarco is not interested in just "selling some more steam traps." Whether you are building new plants, additions, or modernizing old heating systems, you will find that the Sarco Representative near you is interested in finding the right combination of steam traps and temperature controls that will give maximum heating comfort for your workers at less fuel costs. A phone call will bring you his experience with no obligations.

...with no windows AND IT'S ALL-SARCO



FLOAT-THERMOSTATIC STEAM TRAP

PIPE LINE STRAINER



BUCKET STEAM TRAP

331

SARCO SAVES STEAM

IMPROVES PRODUCT QUALITY AND OUTPUT

SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 8, ONTARIO

WORTHINGTON AIR CONDITIONING REPORT

WORTHINGTON PUMP AND MACHINERY CORPORATION
HARRISON, NEW JERSEY

Specialists in air conditioning and refrigeration for more than 50 years

Worthington Air-Conditions a "Jungle"

There is no such thing in the field of professional orchidology as a "Topsy" orchid. No prize beauty ever "jest grew." It takes large measures of patience, love and the nation's best horticultural brains to raise an orchid properly. At McKee Jungle Gardens, Vero Beach, Florida, one of the South's leading departments of orchidology under the direction of David C. Fairburn, PhD., has added air conditioning to the list of requirements for advanced orchid culture.

Rare hybrid orchids must be planted in flasks of sterile food solution under carefully controlled conditions. At McKee Jungle Gardens, Worthington air-conditioning equipment provides precise temperature and humidity requirements for this delicate operation.

Properly controlled interior climatic conditions are the secret of successful development of orchid seedlings. The Worthington air-conditioning plant at McKee Jungle Gardens assures temperatures accurate to a fraction of a degree.

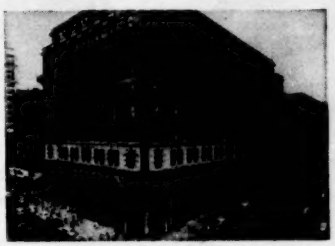
Arthur G. McKee, owner of the project, has raised many uncommon hybrid orchids in greenhouses, developing new strains under controlled temperatures. Some of these have been developed to the point at which they withstand outdoor temperatures and may live year-'round in outside locations throughout the 80-acre Jungle Gardens area. But many rare strains of orchids spend their entire lives—and it takes an average of seven years for an orchid to mature—breathing conditioned air indoors.

At Vero Beach a large fortune in orchids is depending on Worthington air conditioning units. Perhaps the

Worthington Freon-12 condensing units and AHY air conditioning units at McKee Jungle Gardens

greatest single triumph for Worthington and McKee Jungle Gardens has been the successful raising of the ultra-rare Odontoglossum orchids. These are spray orchids native to 15,000 foot altitudes and low temperatures of the Andes Mountains in South America. Attempts to grow these orchids in the South—and in many parts of the North—have ended in dismal failure because the plants could not withstand radically hot summer temperatures. At McKee Jungle Gardens the Odontoglossums are living in a Worthington-made mountain atmosphere that has not only encouraged their healthy growth, but has also aided several complicated hybridizations. Future plans for the Odontoglossum call for a process of "air-conditioning the plants back to the outdoors," a process in which, through scientifically-plotted temperature changes, the plants can be made to adapt themselves to the normal outdoor climate of Florida and other southern states.

Another Big Store is Worthington-Conditioned

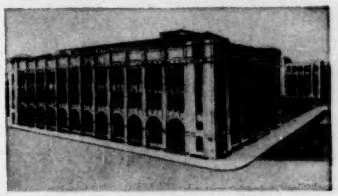


J. L. Brandeis & Sons, Omaha, has installed a Worthington 67C98 centrifugal refrigeration system (647 ton capacity) for air conditioning the lower floors of this store building.
Engineering by Charles S. Leopold Company

No More "Wilted Violets" at the Detroit News

"I am sure it's a wonderful investment for efficiency and production. You should see how bright-eyed and happy the staff looks, whereas the last hot day we were a bunch of wilted violets."

That is a typical comment received by the management of The Detroit News shortly after installation of Worthington air conditioning.



The Detroit News—publisher of the newspaper with the largest ABC-recognized home-delivered circulation in the country.

Worthington centrifugal compressor with condenser and cooler in Detroit News building.

Every minute 240,000 cubic feet of cooled, freshened air is delivered throughout the building to air condition offices, press room and composing room. In the latter two rooms, humidity is carefully controlled, kept low in the composing room, and higher in the press rooms due to static electricity.

Source of the cooling is two Worthington centrifugal compressors, of 200 and 250 ton capacity.

Other Worthington equipment in the installation includes two coolers and condensers and water pumps.

WORTHINGTON

AIR CONDITIONING AND REFRIGERATION

See our exhibit, Booth 103, at the International Heating and Ventilating Exposition, Commercial Museum, Philadelphia, January 22-26

See this CHICAGO PUMP *EQUIPMENT*

at the ASHVE Exposition

CONDO-VAC

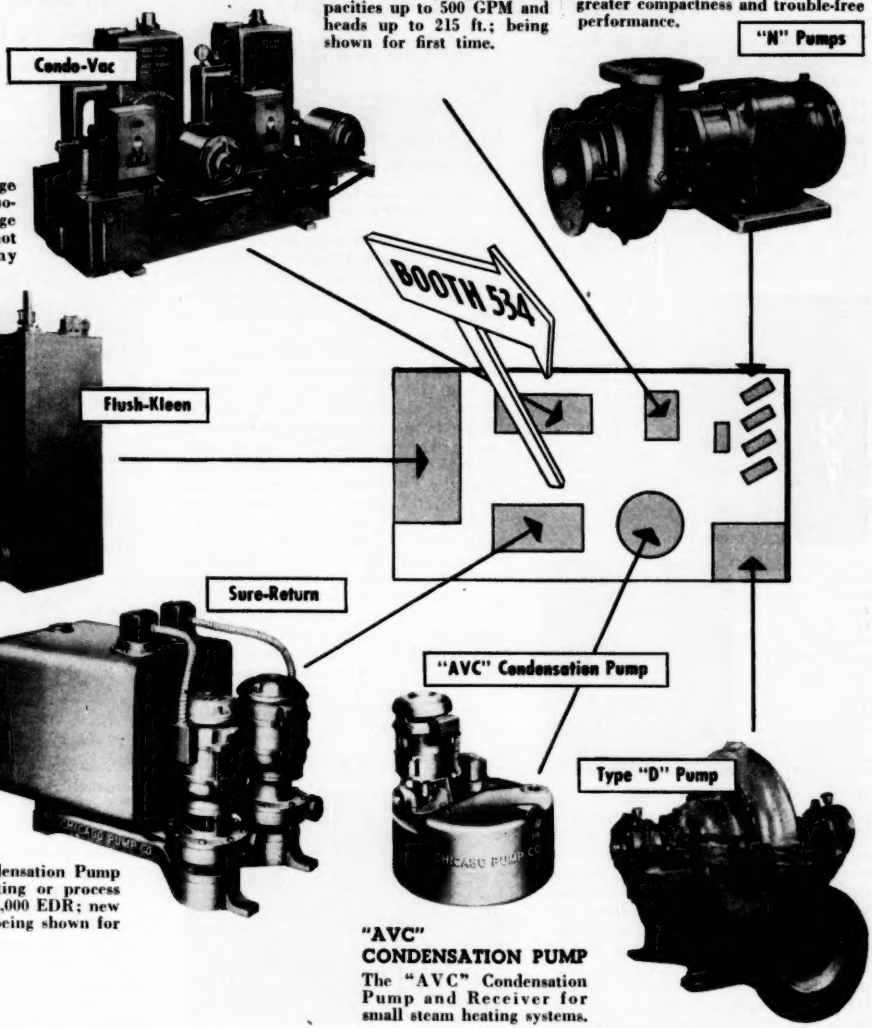
The Condo-Vac Return Line Vacuum and Boiler Feed Pump for vacuum heating systems.

NEW "B" SERIES SIDE SUCTION PUMP

The new "B" Series line of side suction pumps for capacities up to 500 GPM and heads up to 215 ft.; being shown for first time.

"N" PUMPS

Close-coupled "N" Pumps for boiler feed, circulating, tank filling and water supply. Newly designed for greater compactness and trouble-free performance.



FLUSH-KLEEN

The Flush-Kleen Sewage Ejector is the only absolutely clog-proof sewage pump; impellers are not required to pass any solids.

SURE-RETURN

The Sure-Return Condensation Pump and Receiver for heating or process steam systems up to 75,000 EDR; new and improved model being shown for first time.

"AVC" CONDENSATION PUMP

The "AVC" Condensation Pump and Receiver for small steam heating systems.

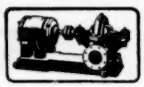
TYPE "D" PUMP

The Type "D" heavy duty building and industrial pump for capacities from 25 to 1900 GPM and heads up to 530 ft.

CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

2300 WOLFRAM STREET **CHICAGO 18, ILLINOIS**



Condo-Vac, Sure Return. AVC, LVC, Fire, House & Circulating Pumps
Pneumatic & Tankless Water Systems

Flush-Kleen Sewage Ejectors
Little Giant & Non-Clog Bilge Pumps
Pumps for every industrial use.

Make our exhibit—in Booth 534—your headquarters throughout the convention.

Famous BRASS RAIL Restaurant saves $5500

on its air conditioning investment with DOREX AIR RECOVERY

When the Brass Rail, Inc., put cooling equipment in its restaurant at 521 Fifth Avenue, New York, the inclusion of Dorex Air Recovery in the air conditioning system reduced needed refrigeration capacity by 25 tons—made a net capital cost saving of $5,500. Since installation, savings in operating costs have run around $500 per year.

YOU CAN SAVE SUBSTANTIALLY, TOO. Dorex Air Recovery pays its way for every operator of an air conditioning system.

Briefly, Dorex Air Recovery "manufactures" *new* air by passing *used* air through Dorex Activated Carbon—the most effective odor-adsorbing agent known. This reduces, by as much as two-thirds, the amount of fresh air that has to be taken into the system—saving substantial heating and cooling costs.

Dorex Air Recovery has been saving money for users for more than 20 years . . . and more than 6,000 users are saving millions annually with it. Find out how Dorex Air Recovery can reduce *your* air conditioning costs. Send coupon today.

DOREX

Air Recovery

W. B. CONNOR ENGINEERING CORP.

Danbury, Connecticut

Air Diffusion • Air Purification • Air Recovery

In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

TRADE MARK "DOREX" REG. U. S. PAT. OFF.

W. B. CONNOR ENGINEERING CORP.
Dept. B-11, Danbury, Connecticut

Please send me, without obligation, full information on Dorex Air Recovery.

Name .....

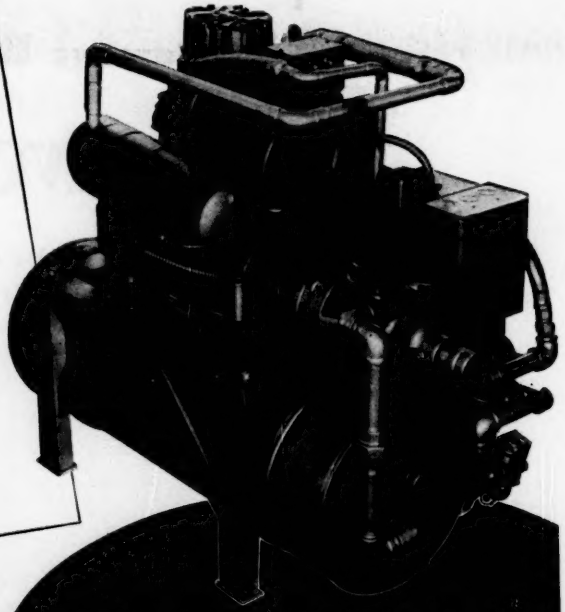
Position .....

Company .....

Street .....

City ..... Zone ..... State .....

OPENS UP NEW MARKETS



Acme FLOW COLD LIQUID CHILLERS

FOR AIR CONDITIONING INDUSTRIAL OR COMMERCIAL REFRIGERATION

ACME FLOW COLD Systems give you the ultimate in Air Conditioning, on hundreds of applications such as professional offices, institutions and hospitals, motels and tourist courts, stores, fitting rooms, hotel suites, beauty parlors, barber shops, homes and many others. Easily adapted to your present Heating System.

ACME FLOW COLD Units are equally efficient for cooling drinking water, and for all industrial process temperature control or commercial cooling operations. ACME FLOW COLD Liquid Chillers are ruggedly constructed and are designed for many years of efficient, low cost service.

ACME FLOW COLD UNITS ARE:

- Compact and Easy to Install.
- Designed for Applications where Space or Access is a Problem.
- Furnished Complete with Wiring, Refrigerant Piping, and all Controls, Factory Tested, Ready for Water and Electrical Connections.
- Matching Acme Convectors, Coils and Cooling Towers.

Contact your nearest distributor or write direct for complete information and specifications.

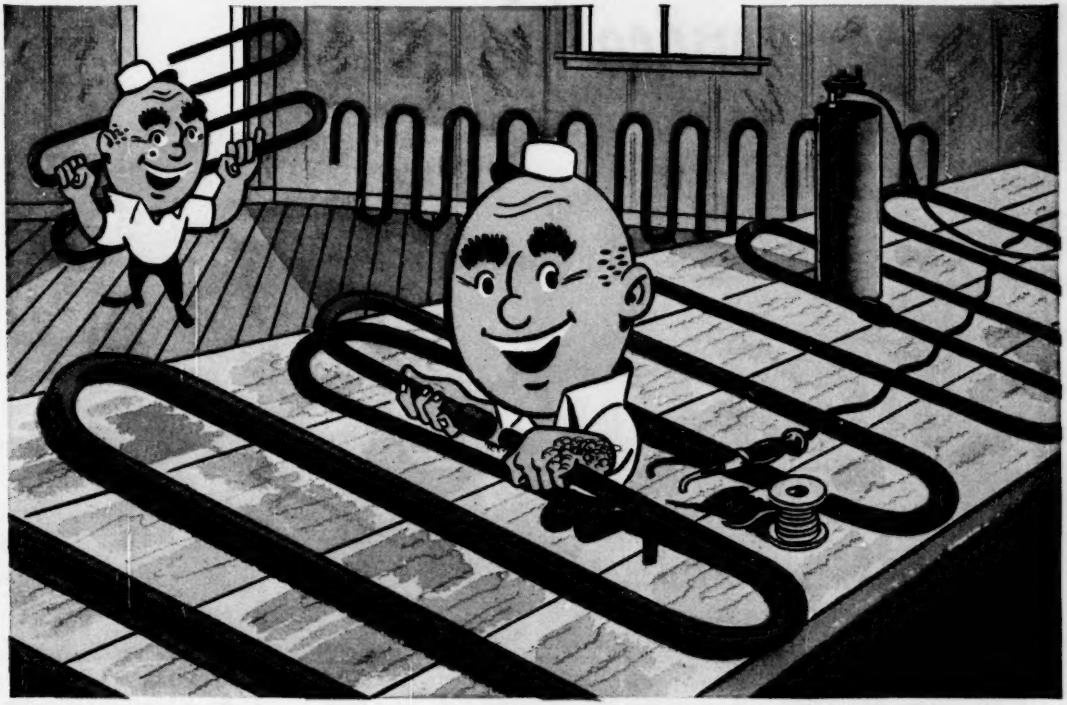
See us at Booths 26 and 414 at the Philadelphia Show in January

"Continuously serving the Air Conditioning and Refrigeration Industry SINCE 1919."

ACME PRODUCTS

ACME INDUSTRIES, INC.

JACKSON, MICHIGAN



Form radiant heating grids faster, too . . . with Bundyweld

NOTE that Bundyweld expanded end, above. It spells *even easier* radiant heating installation!

For twenty-foot lengths of Bundyweld Tubing can be sent to your building site with one end expanded (*if specified*). Then, one man quickly forms grid on simple fixture . . . slips unexpanded end into expanded end of the next grid, and silver brazes (or soft solders) grids into strong, permanent, leakproof union.

Two men can easily position the rigid, lightweight Bundyweld sections on ceilings or in floors. No hitches, delays. In jig time, your Bundyweld radiant heating system is all set, to the tune of a major savings in time and costs.

Bundyweld is double-walled from a single strip, copper-bonded through 360° of wall contact. It's stronger-walled, thinner-walled; bends more readily without collapsing structurally. Uniformity, even flow, maximum heat conductivity are yours!

Write today for the complete Bundyweld radiant heating story. ***Bundy Tubing Company, Detroit 14, Michigan.***

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal, presto—

Bundyweld . . . double-walled and brazed through 360° of wall contact.

NOTE the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.

Longer service life at lower final cost

with dependable
CRANE VALVES

No. 1610 Diaphragm Valve. Ask for literature on full line through your Crane Branch or Crane Wholesaler.

CASE HISTORY FROM CRANE FILES

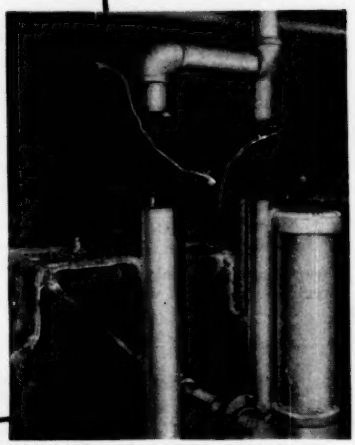
PROBLEM: To find a more efficient and economical replacement for plug cocks having an average life of only 2 to 8 weeks in pipe lines handling liquid clay to filter presses.

WORKING CONDITIONS: Working pressure 140 psi, with liquid clay flow creating highly erosive effect; also corrosive. Strong tendency to clogging. Operating cycles 5 to 6 per day; relatively quick opening and closing required.

SOLUTION: Crane No. 1610 Diaphragm Valves, iron body, packless design, with separate disc and diaphragm.

RESULT: After 11 months' uninterrupted service, Crane valves showed no significant wear or damage resulting from normal operating conditions. User assured of greatly reduced maintenance and replacement costs over plug cocks. No. 1610 Diaphragm valves approved for standardization on all filter press piping.

Another example of the greater value in Crane Quality, and the lower final cost of Crane Valves for every service. That's why . . .
More CRANE VALVES are used than any other make!



The installation—Onondaga Pottery Co., Syracuse

CRANE

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Tri-Flex . . . Aerovane

. . in the Crowell-Collier Buildin

Styled in the best traditions of contemporary architecture . . . designed throughout for utmost efficiency . . . this modern home of the world-known publishers of *Collier's, Woman's Home Companion,* and *The American Magazine* is the latest addition to the New York skyline . . . and like so many other important air conditioned installations from coast to coast, Tri-Flex and Aerovane Grilles and Registers were selected to insure maximum, flexible control of air delivery . . . to meet the most exacting requirements of performance.

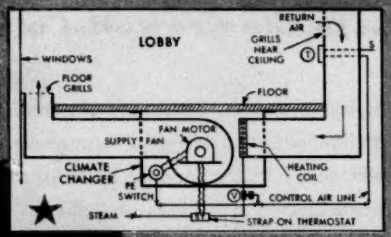
TUTTLE & BAILEY inc

NEW BRITAIN, CONNECTICUT

Chemistry Building, Chicago

POWERS

Modern graduated acting pneumatic thermostats and control valves fit every requirement.



★ NOTE the novel solution to problem of supplying heat and ventilating in an unobtrusive manner. Strap-on thermostat prevents operation of fan when no steam is available. Pressure electric switch stops fan after valve is closed.

Left: View from inside Metallurgical and Chemical Engineering Building shown below.

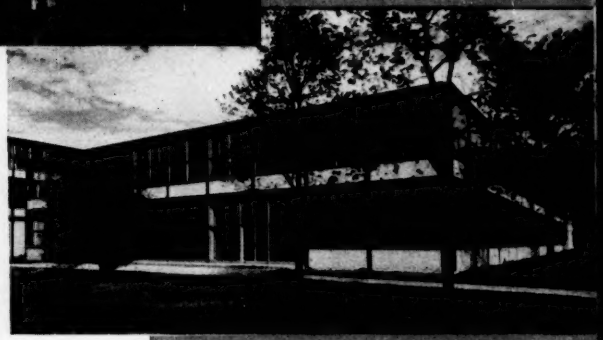
ILLINOIS INSTITUTE of TECHNOLOGY

Architect
Ludwig Mies van der Rohe

Associate Architects: Friedman, Alschuler & Sincere; and Holabird & Root & Burgee

Consulting Engineer: Robert E. Hattis

Heating Contractor: Economy Plbg. & Heating Co., All of Chicago, Ill.



POWERS

Pneumatic Systems of TEMPERATURE CONTROL are installed in the following buildings

Chemistry Building • Metallurgical and Chemical Engineering • Institute of Gas Technology • Association of American Railroads • Alumni Memorial Hall • Network Calculator Laboratory • Sound Laboratory • Armour Research Laboratory • Machinery Hall

In 1990 will the Powers installations at Illinois Tech still be giving dependable control?... Nearby, in the Drake Public School, a Powers pneumatic system of temperature control is still giving reliable service after 49 years.

Many users report 25 to 40 years of low cost control from Powers regulation. So, with the better modern equipment now being used, 1990 may be only the half-way mark for present day Powers systems.

When you want temperature control that will provide maximum comfort and fuel savings with lower operating and maintenance cost, contact Powers nearest office. There's no obligation.

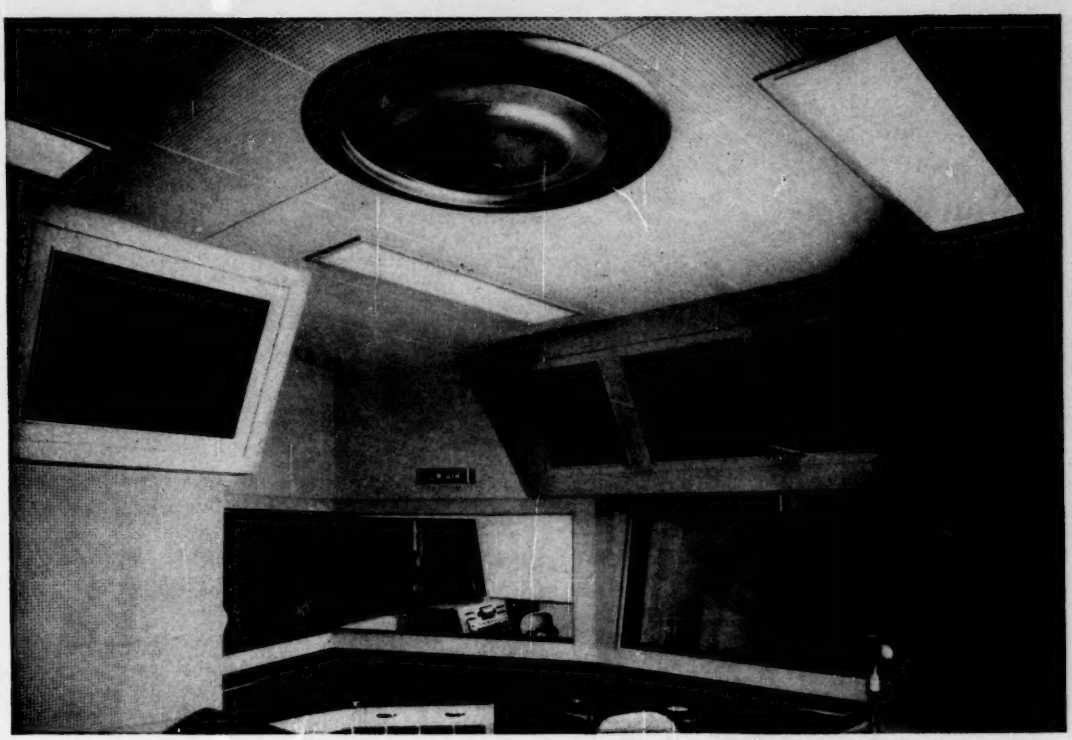
POWERS MASTROL-SYSTEM OF CONTROL FOR FORCED HOT WATER HEATING SYSTEMS.

THE POWERS REGULATOR CO.

Established 1891 • OFFICES IN OVER 50 CITIES • See Your Phone Book

CHICAGO 14, ILL., 2718 Greenview Ave. • **NEW YORK 17, N.Y.,** 231 E. 46th St.
LOS ANGELES 5, CAL., 1808 West 8th St. • **TORONTO, ONT.,** 195 Spadina Ave.
MEXICO, D. F., Edificio "La Nacional" 601

(RCIT)



Control Room: Radio Station WFDR, New York, N. Y.
Architect: Robin and Vogel, New York, N. Y.
Engineer: Fred L. Moesel Associates, New York, N. Y.
Mechanical Contractor: The J. M. Fink Co., New York, N. Y.

Twice beautiful to the engineer's eye...

kno·draft adjustable air diffusers

Beautiful to look at, of course...with an unobtrusive simplicity that is as much at ease amid the crystal chandeliers of a ballroom as in the stark severity of a broadcasting studio.

But the engineering eye sees also the functional beauty of Kno-Draft *Adjustable* Air Diffusers . . . the uncomplicated cleverness of engineering and design that assures an even distribution of air *without draft*.

Kno-Draft Air Diffusers are adjustable *after* installation. Both the volume of air and its direction can be screw-driver controlled to balance temperature and distribution *exactly as required* throughout the entire conditioned area.

Still a third "beauty" of Kno-Draft *Adjustable* Air Diffusers is the complete satisfaction they give on the job. Types and sizes to meet every need.

KNO-DRAFT DATA BOOK: Complete specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. To get your copy, simply fill in and mail the coupon. No obligation, of course.

TRADE MARK "KNO-DRAFT" REG. U. S PAT. OFF.

W. B. CONNOR ENGINEERING CORP.
Danbury, Connecticut
Air Diffusion • Air Purification • Air Recovery
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

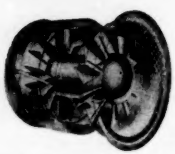
W. B. CONNOR ENGINEERING CORP.
Dept. J-11, Danbury, Connecticut
Please send me, without obligation, my copy of the Kno-Draft Air Diffuser Data Book.

Name .....
Position .....
Company .....
Street .....
City .....**Zone**.....**State**.....

REVOLVING

Wing

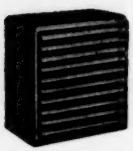
VARIABLE TEMPERATURE HEATER SECTIONS



MOTOR-DRIVEN BLOWERS

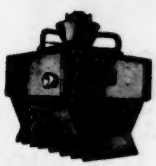
TURBINE UNIT HEATERS

TURBINE-DRIVEN BLOWERS

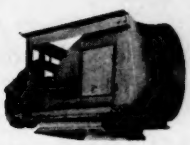


UTILITY UNIT HEATERS

SAFETY VENTILATING FANS

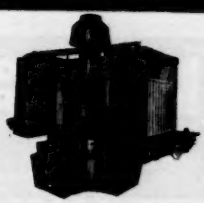


HIGH VELOCITY FIXED DISCHARGE UNIT HEATERS



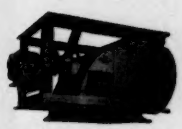
DUCT FANS *Elbow Type*

DUCT FANS *Straight Line Type*



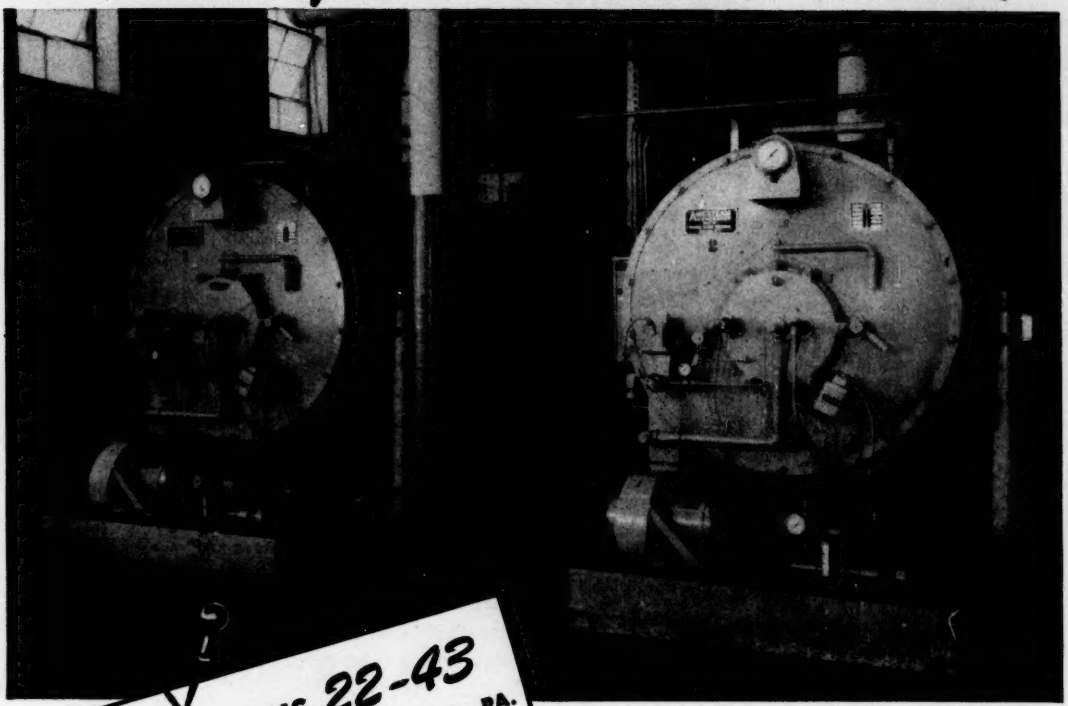
GAS-FIRED UNIT HEATERS

STEAM TURBINES



FURNACE DRAFT INDUCERS

What's Your STEAM *Problem?*



VISIT BOOTHS 22-43
COMMERCIAL MUSEUM – PHILADELPHIA, PA.
JANUARY 22-26, 1951
For the Answer!

AMESTEAM GENERATOR

A Compact, Self-Contained Unit — Automatic, Efficient, Quick Steaming

- **AUTOMATIC OPERATION** — from a cold boiler to full operating pressure in only a few minutes — just press the button.
- **ECONOMICAL OPERATION** — guaranteed 80% efficiency. Fuel consumed only as steam is used. Combination Units available for quick change-over to either oil or gas to meet changing fuel availability.
- **ACCESSIBILITY** — rear flue cover and baffle easily removed for cleaning and inspection. All equipment installed in easy-to-get-at locations.
- **NO "EXTRAS" NEEDED** — in addition to the minimum equipment usually furnished with Units of this type, our standard unit for over 15 pounds design steam pressure regularly includes:

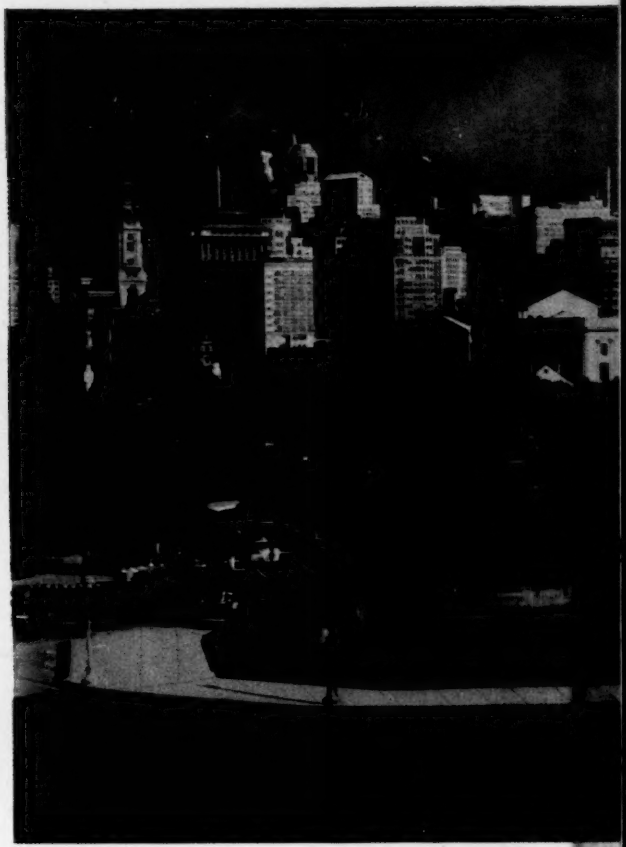
Condensate Tank • Blow-off Valve • Feed Pump Unit • Injector • Main Steam Valve • Necessary Refractories • Insulation and Metal Jacket

Write for Bulletin 1011-C

Gives complete data on the AMESTEAM GENERATOR to meet your needs — oil, gas or oil-gas combination — 10 to 500 h.p., 15 to 200 lbs., as desired. WRITE TODAY!

AMES IRON WORKS
BOX 3001, OSWEGO, N. Y.
Builders of Better Boilers since 1848
Manufactured under License in Canada by VOLCANO Ltd., Montreal, P. Q.

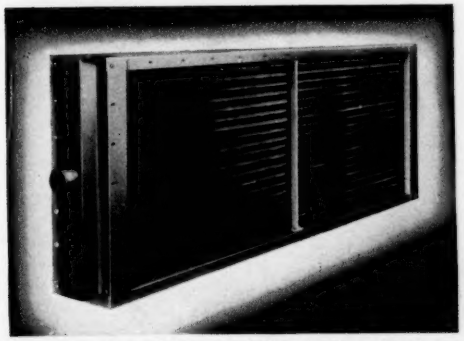
American Blower—a time-honored name in air handling



If you look before you buy, we're certain you'll buy American Blower Air Handling Equipment. There's a vast difference in quality, design, operating costs and efficiency between American Blower and ordinary equipment. In test after test by buyers, comparison proves the superiority of American Blower products.

In Philadelphia, as in other cities, American Blower Air Handling Products have been serving commerce, industry and public utilities for over half a century. If you attend the Heating and Ventilating Exposition January 22-26, 1951, you are extended a cordial invitation to visit our exhibit in Booth A.

Product of the month



Type S Steam Coil for normal blast heating. Tested and guaranteed for operation with steam pressures to 200 lbs. gauge and steam temperatures to 450°F. Write for Bulletin B-1218.

The heat's on!

The heat is *really* on. Current demands for heating from business and industry are greater now than ever before.

That's all the more reason for early action on your part if you want American Blower Heating Coils.

Whether you need coils for blast heating, zone reheating, or whether you want return bend coils or coils for modulated steam control—you'll find the size and type that best fit your needs in the American Blower line.

All tubing in American Blower coils is helically wound with copper or aluminum fins in three standard spacings. Coil casings are built of heavy galvanized steel; headers are of die-formed steel.

For further data contact the nearest American Blower Branch Office.

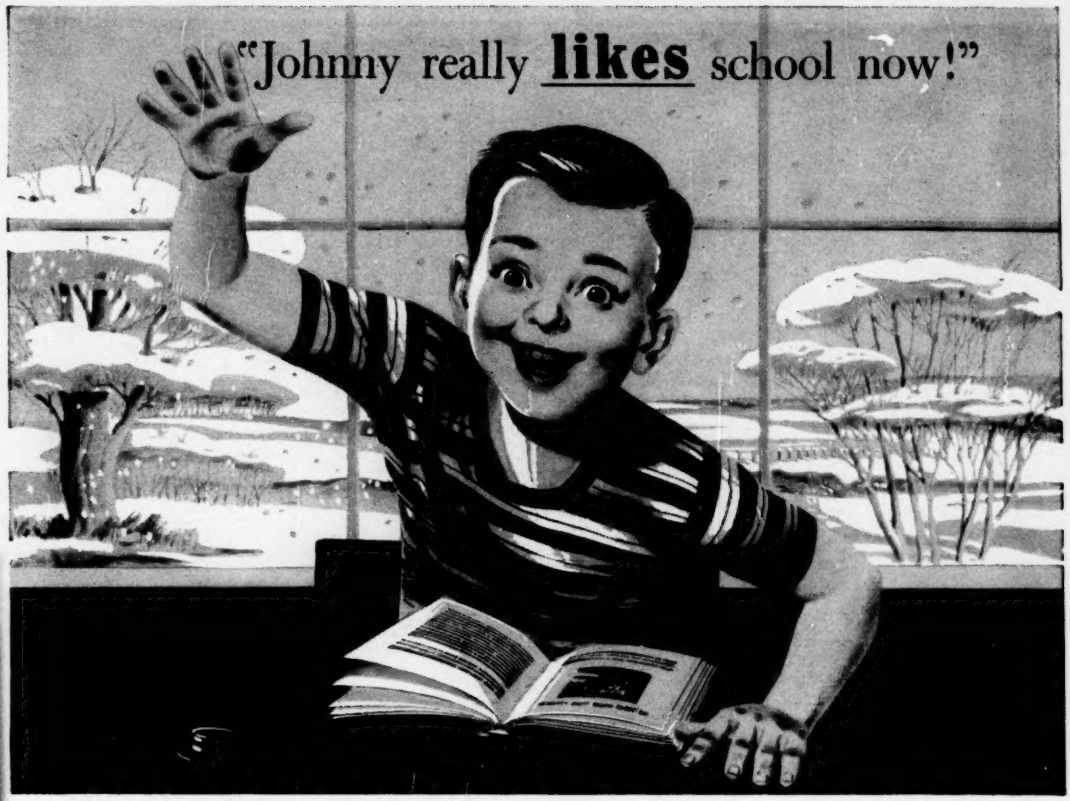
AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation

YOUR BEST BUY AMERICAN BLOWER AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON



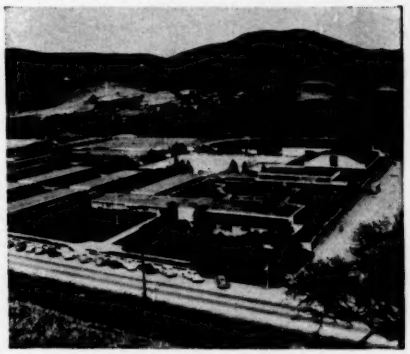
Steel pipe is first choice for radiant heated schools

It's a good thing Shakespeare didn't live in our day for he would have had to revise those familiar lines about the school boy . . . "creeping like snail, unwillingly to school!" Our millions of grand American kids really *like* school now!

And why shouldn't they? Americans believe firmly in the right of every youngster to get a good start in life! As a result our schools not only stimulate young minds but provide every comfort that science can devise and money can buy to make learning enjoyable, healthful and comfortable.

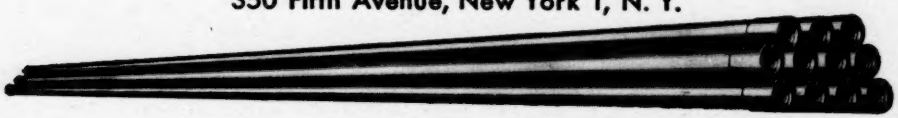
Good lighting, ventilation, and heating are "musts" in America's modern schools. In the newest ones even the advantages of *radiant* heating are included. And because "the best is none too good" steel pipe is first choice for these radiant installations.

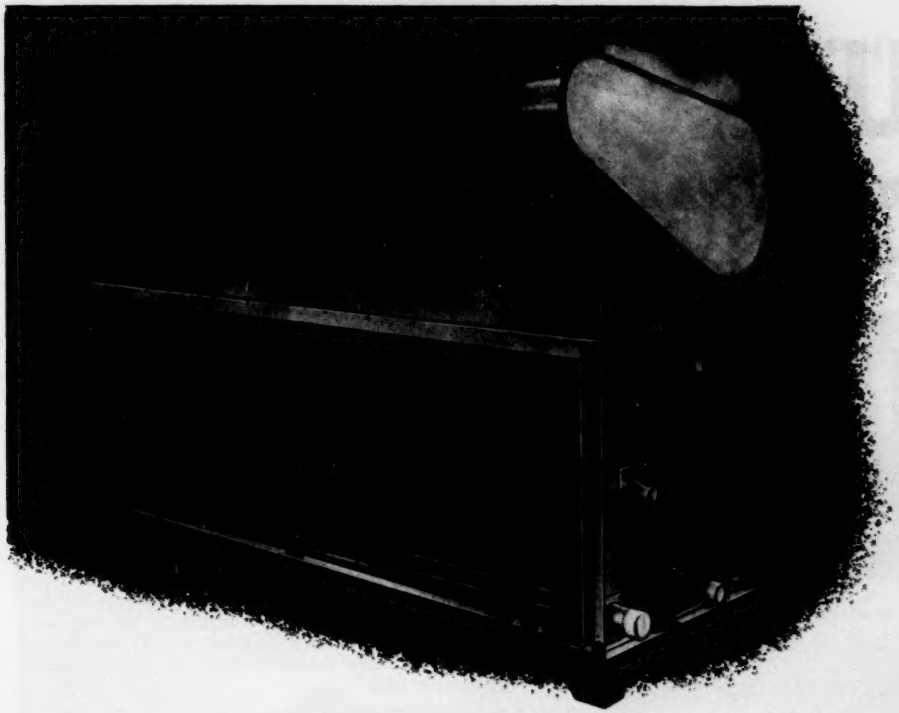
There are many reasons why! Steel pipe has been proved in more than 60 years' service in conventional hot water heating systems and, in addition, meets the *specific* piping requirements of radiant installations in *every* particular . . . from economical first cost to complete mechanical adaptability!



Modern schools like this new Acalanes Union High School, Lafayette, California, use steel pipe in floor panel radiant heating installations.

COMMITTEE ON STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
350 Fifth Avenue, New York 1, N. Y.

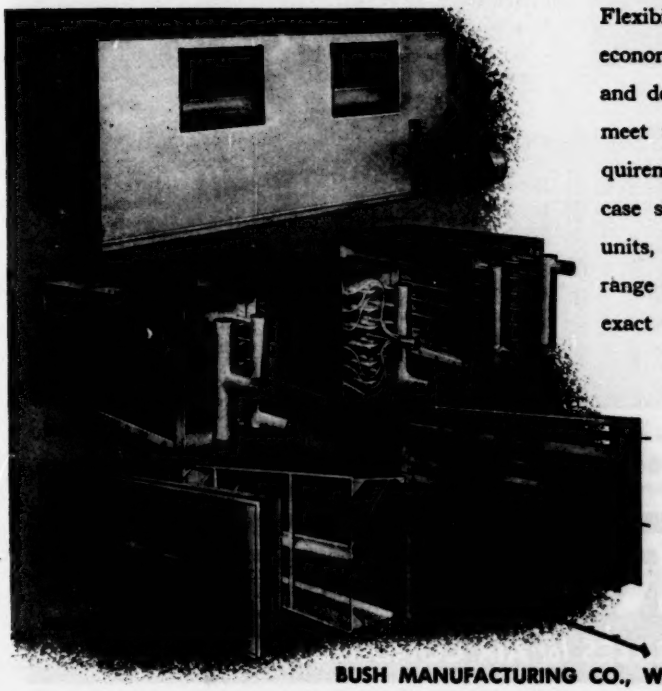




VERTICAL AIR HANDLING UNIT
Illustrated (left) available with face and by-pass dampers, choice of either flat or V-type filter sections with throw-away or cleanable type filters, humidifiers, and wide variety of coil selections.

See the Bush Line at Booth 817, 10th Annual Air Conditioning Exposition, Commercial Museum, Philadelphia, Pa., January 22-26.

Air Handling UNITS BY BUSH



Flexibility of component parts assures efficient, economical delivery of filtered air . . . cooled and dehumidified or heated and humidified to meet the all-year-'round air conditioning requirements of products or personnel. Eight case sizes, in either floor or ceiling mounted units, are available . . . with an overlapping range of air deliveries to meet specifically the exact demands of any application.

Buy the Best — and the Best is Bush

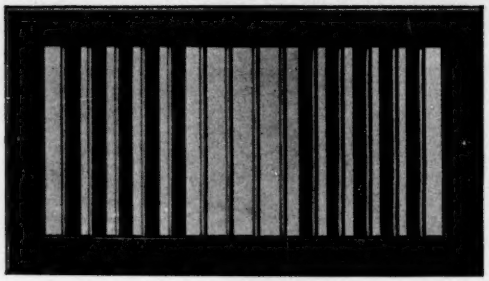
Bush
HEAT TRANSFER PRODUCTS

BUSH MANUFACTURING CO., WEST HARTFORD, CONN.

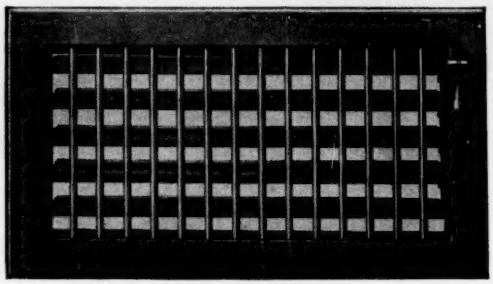
AUER "Streamliners"

Rank with the very finest in Registers and Grilles for

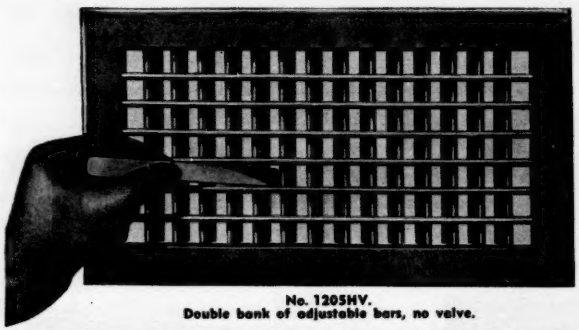
HIGH VELOCITY OUTLETS



No. 1005V.
Single bank of adjustable bars, no valve.



No. 1005V-HML.
Single bank of adjustable bars, with multi-louvre valve.



No. 1205HV.
Double bank of adjustable bars, no valve.

In fact Streamliners, giving multiple deflection for high velocity systems of air conditioning, ventilating, or cooling, are, in some respects in a class by themselves. For use as grilles they are made with single or double banks of adjustable bars. Registers are also made single or double face, with multi-louvre volume control. Note these special features:

- The hollow moulded bars, smooth in contour, are pivoted in the frame on unique split sleeves, or expansion inserts, effective for the life of the register. These furnish just enough tension to hold bars firmly where set, yet allow sufficient play to adjust accurately with simple tool.
- Each bar is pivoted in its exact center, and shaped somewhat similar to an airplane wing, so that for either return or supply, each bar can be completely turned around. For outlets, some users turn the thin edge to the front, and the broader edge toward the flow of air, thus using a basic theory of aerodynamics, and reducing resistance and turbulence to a minimum.
- Blades of multi-louvre volume control are pivoted on tension rivets to guard against vibration or noise, another important feature. These registers are absolutely quiet even at high velocities.
- There is nothing, so far as we know, to wear out, pull loose, or give way in service, in a Streamliner.

8 MODELS. The Series includes models with single bank of adjustable bars (vertical or horizontal), also with double bank of adjustable bars (vertical in front and horizontal in back, or the reverse), also all above four types with the addition of horizontal multi-louvre valves in the rear, controlled by lever on face of register.

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Why the sea is salty

IN Norse mythology, a poor man got a magic mill from the elves. With it he could grind whatever he wanted--food, clothing, furniture, and best of all, gold. Of course, the poor peasant's lot changed from poverty to riches.

An envious brother borrowed the mill. He commanded it to "grind herrings and broth and grind them good and fast." But having taken the mill in such haste, he didn't know the magic words to shut it off. He was almost drowned in broth when the brother came to the rescue.

Finally, the magic mill was stolen by a salt dealer, who put it on his ship. Safely at sea, the skipper demanded, "Grind salt and grind it good and fast." Alas, he hadn't learned the control words either. The mill ground salt endlessly, filling all his kegs and his hold, covering the decks and at last sinking the ship. There at the bottom of the sea, so people say, the magic mill still grinds--and that's why the sea is salty.

From time immemorial, men have dreamed about magic mills and schemes to bring abundance and riches. Here in America, today, there are plans that are flooding us with superabundance of certain commodities. But what about the magic words to shut off the mill?

Isn't it time we see the truth in this ancient Norse myth, that "too much" is just as foolish as "too little?" We may well remember this first law of economics: In a *free* market, supply can adjust itself to demand--whether it be potatoes or steel--without sinking the ship. Here is a must job for all thinking Americans.

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"3 valves in 1"

TYPE TCL

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Multi-Outlet

TYPE 402
with pressure limiting feature

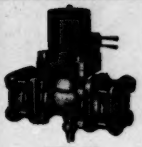
THERMO-LIMIT
with pressure limiting feature

For automatic control of liquid refrigerant on all types of refrigeration and air conditioning systems. Capacities: from fractional tonnage to 50 tons "Freon-12", 100 tons Methyl Chloride. Low temperature valves for −40° F. to −100° F.

SOLENOID VALVES

TYPE S1

TYPE M3



TYPE R2

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high pressure float valve

Up to 5 tons "Freon-12", 10 tons Methyl Chloride and 20 tons Ammonia.

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For "Freon", Methyl Chloride, Ammonia and other non-corrosive liquids having a specific gravity of .6 or more. Up to 460 volts AC and 250 volts DC.

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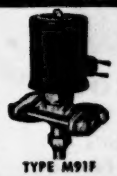
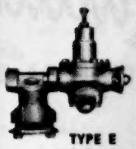
AMMONIA CONTROLS

TYPE TG



TYPE M91F

TYPE UGZ



TYPE E
with Strainer

SUCTION LINE CONTROLS

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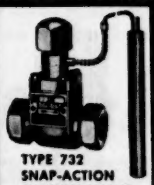

TYPE 732
SNAP-ACTION SUCTION VALVE

Temperature operated —½ ton, "Freon-12"—1 ton, Methyl Chloride.

TYPE 760
"EVAPOTROL"

Pressure regulator—½ ton, "Freon-12"—⅜ ton, Methyl Chloride.

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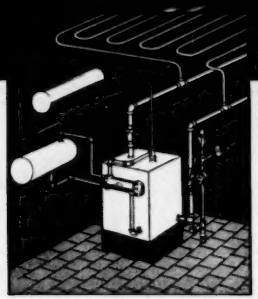

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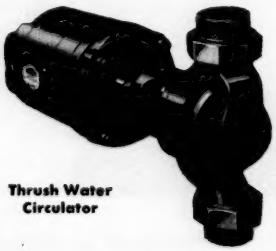

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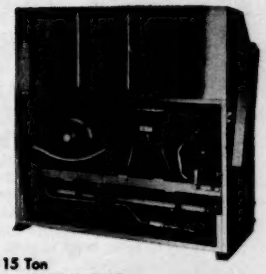

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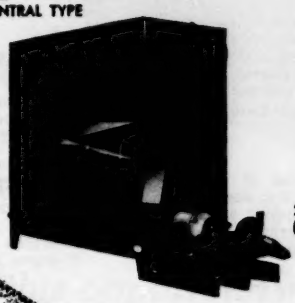

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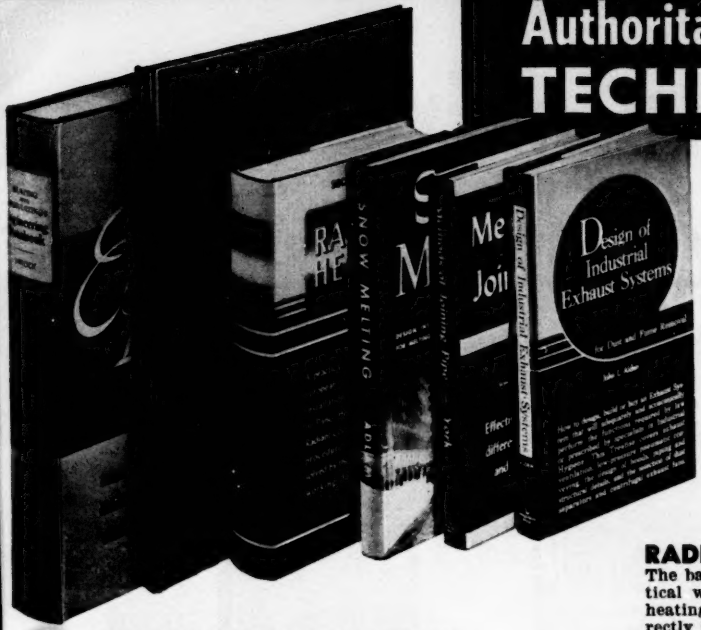

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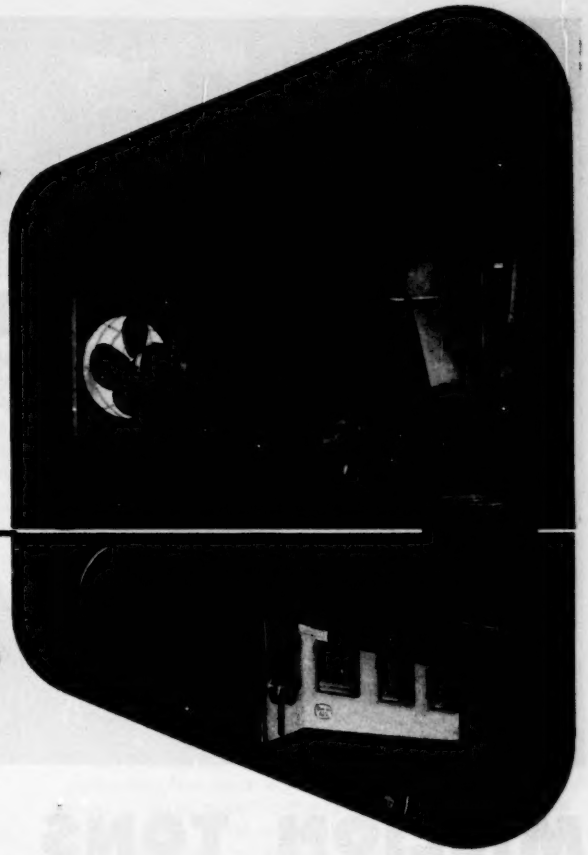

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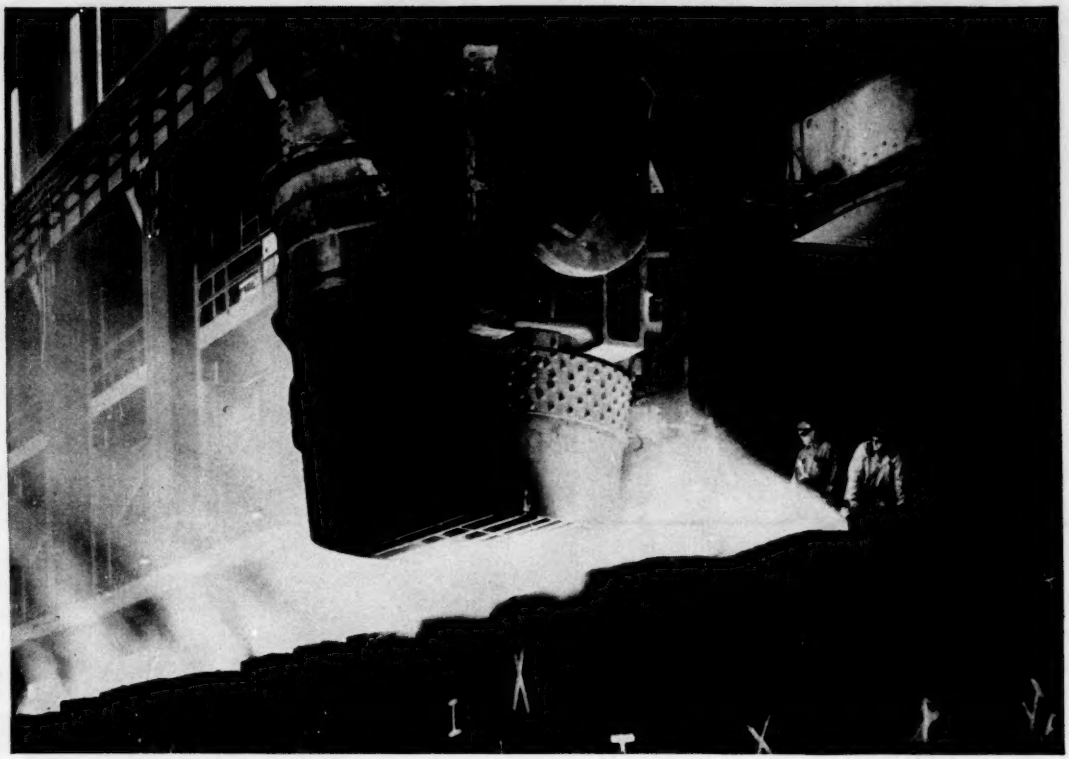

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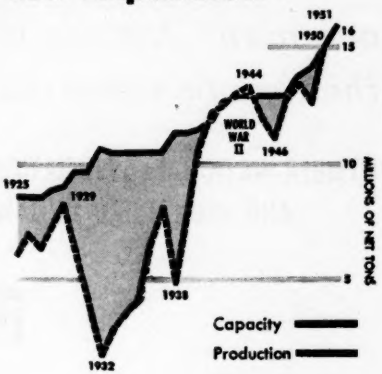
On January 1 of this year Bethlehem's steel making capacity stood at 16 million ingot-tons annually—*an increase of 1 million tons* over a year ago.

Since the war ended we have increased our annual steelmaking capacity *3,100,000 tons, or 24 per cent.*

Moreover, as the chart at the right shows, Bethlehem's steel capacity has nearly doubled in 25 years. Additional capacity can and will be created as it is needed.



BETHLEHEM STEEL ★ BETHLEHEM STEEL ★

Washington News

LORING F. OVERMAN

FOR the second time within a decade, Washington is making feverish preparations to take over the national economy on behalf of the military.

And December was indeed a month of decision. As the month opened, officials contemplated a leisurely period of defense preparation. Mobilization of production and manpower was being planned in such a way as to rearm the United States in four years.

Overnight, official thinking changed to include:

1. Declaration of National Emergency.
2. Creation of new Office of Defense Mobilization.
3. Issuance of first mandatory price control.
4. Stepped-up mobilization of armed forces.
5. Stockpiling and export barriers.

Since each December decision had an as-yet-undetermined impact upon the heating, ventilating and air conditioning industries, it may prove interesting to examine the several phases of the new program.

National Emergency

There are mixed reactions in Washington as to the reasons for and the probable results of the President's Proclamation of a National Emergency. All agree that one purpose was to put the American public on notice that the period ahead is sufficiently serious to justify more guns at the expense of butter. Some wonder if the proclamation is primarily a bid for political power. Others question the wisdom of putting Russia on notice that we are so concerned. In the final analysis, however, there are no indications that anyone—at least anyone loyal—would think of dragging feet on the defense program just because the full seriousness is questioned.

For any who doubt, the stock answer seems to be, "If you knew what we know, you wouldn't take a chance." Yes, doubters are answered just that way, and all conferences, briefings, and behind-the-scenes glimpses send conferees home with the idea that it is better to be safe than sorry.

Another straw in the wind is that men prominent in the business world leave their civilian affairs, accept defense appointments, and immediately become apparently sincere and extremely convincing proponents of the get-the-job-done type of controls which they, as businessmen, customarily oppose as counter to the American way of life.

New ODM Created

Consider, for example, the evidence that must have been presented to induce Charles E. Wilson to resign as president of the General Electric Co. to head up a new Office of Defense Mobilization. Mr. Wilson was chairman of the War Production Board during World War II. He knows that the headaches outweigh the honors. He knows the job, and if it looks to Charles E. Wilson like he can best serve his country at the head of a new war coordination agency, then this country is fortunate that he is willing and able to serve.

Creation of a new central defense agency will step on a few political toes in the old-line government agencies charged with responsibility for the job as originally conceived under the Defense Production Act of 1950. But creating the new agency early in the defense program should make the transition to a strong, coordinating force less painful than if the initial concept had been permitted to continue for long.

Status of NSRB, the National Security Resources Board, under the ODM blueprint is also undetermined. NSRB's W. Stuart Symington was ordered to coordinate the defense mobilization program under Executive Order 10161. He was also given authority to issue certificates of necessity and to consider requests for direct loans to expand production facilities. At the moment it would appear that there are two heads to the defense body. A second look, however, reveals that Mr. Wilson's authority supersedes that of NSRB. It begins to appear that NSRB will retain its planning functions and serve largely as an advisory group to the President.

Key Appointments

More evidence that the defense program is to get under way fast came with the late-December announcement of three more top-drawer names to direct phases of the work. ODM Director Wilson named two and NPA Administrator William Harrison appointed one. Mr. Wilson's appointments were General Lucius Clay, former U. S. Commissioner for Germany, and Sidney Weinberg, former vice chairman of the War Production Board. Mr. Harrison's appointment brought back Walter C. Skuse as director of NPA's Production Controls Staff. Mr. Skuse was director of the WPB Controlled Materials Plan division during World War II, and was deputy vice chairman for operations.

The latter appointment strengthens the conclusion that NPA will continue to be the operating arm for the Office of Defense Mobilization. NPA still contends that it does not expect to get a controlled materials plan started before the third quarter of 1951, but the return of Mr. Skuse to the driver's seat indicates that a stepping up of the date may be quite likely.

Under a controlled materials plan, the government would prescribe amounts of basic metals such as steel, copper and aluminum, which each manufacturer can buy for both his military and civilian consumption. Allocations would be based upon how essential the end products are considered. The controls would be considerably more detailed than the across-the-board cutbacks already ordered for several metals: aluminum 35% (beginning March 1, with a 20% cutback in January and 15% cutback in February); copper, down 15%; nickel, down 35%; zinc, down 20%; tin, down 20%.

During the last week in December, a cobalt order

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to install pipe

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TUBULAR AND HOT ROLLED PRODUCTS

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limiting civilian use to 50% of average consumption during the first six months of 1950 was anticipated.

Price Freeze

How seriously the new defense agencies take their assignments is revealed by the Economic Stabilization Agency's crackdown on auto firms which had refused to accede to the ESA request to rollback announced increases in auto prices. The agency, issuing the first price order since it was formed, rolled prices back to December 1.

In refusing the idea of a voluntary rollback, the auto companies pointed to increased cost of materials and labor since the Korean War started. The auto price increase, of approximately 5%, followed increases of 5.5% in prices of steel. Auto manufacturers expressed themselves as being disturbed over being singled out for a rollback, when steel has been permitted—to date at least—to enforce its increase.

Steel producers and scrap dealers held a series of meetings in Washington during December, and it was hinted that a freeze in those fields might be anticipated if no voluntary action is forthcoming.

"Price Standards" announced on December 19 by the Economic Stabilization Agency are indeed applicable to the heating, ventilating and air conditioning industry.

Although the ESA announcement was merely a press release outlining a policy, it served notice that when, if, and as pricing orders are issued—either on an across-the-board basis or selectively—ESA regards December 1, 1950 as the "thus far and no farther" point for prices.

The press release also indicated that unless ESA sees evidence of voluntary compliance, violators may expect mandatory price orders. That is exactly what the agency told automobile manufacturers. When no voluntary rollback developed, ESA "rolled its own." Auto firms conceded defeat and yielded under protest.

The ESA statement of policy is unique in that it represents one of the few examples of a government agency having announced in advance what its policy will be under a ruling or regulation yet to be issued. Customarily, a regulation is issued and it remains for administrators or the courts to determine the intent of the order, legislation, or regulation.

In this instance, paraphrasing the sidewalk pitchman, ESA has said, "Now here is what we're going to do." And like those who hear the pitchman, the sidewalk listeners found the story hard to believe.

Current evidence is that ESA means business. Since the "Price Standards" apply to both products, and services, heating and ventilating pricing men will wish to see copies of the press release. They may be secured by writing the Economic Stabilization Agency, Washington 25, D. C. Of necessity the press release cannot be as specific as an official ESA order. This is probably fortunate for it leaves certain leeway, and possibly some loopholes. But the intent is clear. The agency served notice that any official price action hereafter taken by ESA will make use of a base period ending not later than December 1, 1950, and that no seller will derive any advantage under the regulations from price increases after that date.

"Prices of certain basic materials," the order says, "which were increased during the period between June 24 and December 1, 1950, will be subject to reduction in accordance with these standards where that is necessary to make possible the maintenance of December 1 price levels at later stages of manufacture."

Manpower Squeeze

Stepping up of the military mobilization program will bring about a long series of repercussions. In a radio broadcast to the nation, President Truman announced that the next step would be to increase the armed forces as rapidly as possible to three and one-half million.

"At the same time," said the President, "we will have a very rapid speed-up in the production of military equipment. Within one year we will be turning out planes at five times the present rate of production. Within one year, combat vehicles will be coming off the production line at four times today's rate. Within one year the rate of production of electronics equipment for defense will have multiplied four and one-half times.

"If we are to make the weapons we need soon enough, we shall have to cut back on many lines of civilian production. We cannot build up and maintain our armed might and the industrial strength underlying it, simply by cutting back civilian production. We must also produce more—more steel, more copper, more aluminum, more electric power, more cotton, more of many other things."

Typical of the changes of which Mr. Truman was speaking is the present estimate of military construction for 1951. In late November it was reported that military construction for 1951 would probably not exceed $200 million. But on December 12, a bill authorizing approximately $1.6 billion for Army, Navy, and Air Force construction was introduced by Carl Vinson, Chairman of the House Armed Services Committee. Five days later the bill, HR 9893, had been passed by both House and Senate, and was on the President's desk for signature. The bulk of the money will be spent in this country, with the remainder covering building projects in Alaska and Hawaii.

Defense Contracts

H & V readers holding defense contracts or hoping to secure them will be interested in the progress of S 4266, the proposal to reinstate World War II procedures for modifying contract terms. The Senate approved the measure on December 21, but the House postponed consideration until January 1.

The bill would permit these contract changes: (1) the amendment and modification of current contracts without readvertising for bids; (2) execution of contracts with indemnity provisions for contractors in dangerous areas; (3) permit advance payments on contracts and the delegation of this authority to lesser officials of the defense establishment; and (4) waiver of bond requirements on certain construction projects. Major purpose of the bill is to provide the President with authority to revise existing defense contracts to take care of "hardship" cases where a contractor is faced with financial difficulties because of increasing costs since his government contract was obtained.

BRIEFLY STATED

• The Westinghouse Electric Corp. has received an order from the U. S. Air Force for $20 million worth of electrical equipment for a new wind tunnel to test full size jet engines, guided missiles, and wing sections and fuselages of aircraft. The wind tunnel will be built at the Arnold Engineering Development Center, Tullahoma, Tennessee. It was renamed recently in honor of the late General H. H. "Hap" Arnold, wartime head of the Army Air Force. Of four big electric motors to be built for the new tunnel, two will be the most powerful in the world, exceeding the 65,000 hp rating of the motors—also built by Westinghouse—now in service at Grand Coulee Dam in the State of Washington. The Sunnyvale, California, plant will make a big air compressor to push air through the tunnel at speeds up to and above the speed of sound. The compressor will be the world's largest rotating machine.

• Dr. C. Richard Walmer, medical director of the Industrial Hygiene Foundation, has been named managing director of that organization to succeed the late John F. McMahon. The Foundation operates under the auspices of Mellon Institute. Dr. Walmer, who has been medical director of the Foundation and also a senior fellow of Mellon Institute since 1946, will now be an administrative fellow in the Institute. He is a widely known specialist and is on the staff of three hospitals in the Pittsburgh district.

• A plant for filling and distributing liquefied petroleum gas is being built by Socony-Vacuum Oil Company, Inc., in South Norwalk, Conn. It is expected to open about the middle of January.

• I. R. Hoffman, after 20 years as fuel engineer and sales consultant with Central Petroleum Corp., Central Coal Co. and affiliated concerns, has resigned to accept the post of president of Associated Petroleum, Inc., fuel and equipment dealers operating in Queens and Nassau counties, Long Island.

• Secretary Chapman has appointed Charles W. Connor administrator of the Defense Solid Fuels Administration. Mr. Connor, who has been serving as a consultant in the formation of the solid fuels defense agency, has been in charge of coal mining operations for the Armco Steel Corporation at Montcoal, W. Va., previous to which he had been superintendent for the Solvay Colliery Company, Maryton, W. Va.

• A major gain recorded in 1950 by the electric light and power industry was the installation of 6.7 million kilowatts of new generating capability. Power generation moved sharply up during the year, reaching a new high for the electric industry of 328 billion kilowatthours, nearly 12% greater than the previous record output of 1949. The addition of 58 billion kilowatthours generated by industrial and railway plants for their own use brought electricity production by all sources in the U. S. to a total of 386 billion kilowatthours for 1950.

• Joseph W. Kreuttner, formerly vice president and general manager of Air & Refrigeration Corp., has been appointed to the general sales department of Buensod-Stacey, Inc., with headquarters in New York City.

• Ten 86-hp low pressure York-Shipley Steam-Pak generators are used to provide heat and hot water in the new Grant Village Development at Syracuse, N. Y.

• Thomas D. Jolly, vice president of the Aluminum Company of America, has been elected president of the American Standards Association. It will be his third one-year term as president.

• Frederick W. Smith has been elected president of the Baker Refrigeration Corp., South Windham, Maine. Mr. Smith joined the Baker organization in January, 1950, as vice president in charge of sales, and in August was named executive vice president. He was previously associated with the Frigidaire Division of General Motors and the Carrier Corporation.

• Construction is well under way for a large addition to the modern manufacturing plant of Jas. P. Marsh Corp., in Skokie, Illinois. The addition will increase manufacturing space by about 17,000 square feet.

• Improved manufacturing methods and newly designed products largely account for the 32% gain in net earnings of York Corp., it was announced upon issuance of the company's annual statement for the year ending September 30, 1950. The company also reported a 13% increase in orders booked. Completed sales for the year amounted to $49,088,198. Earnings after provisions for taxes at the increased rates effective July 1, 1950 were $2,139,445, equivalent to $13.37 per share of preferred stock. After provisions for preferred dividends, earnings on the common stock total $1.91 per share.

• Stanley K. Smith, president of The H. B. Smith Company, Westfield, Mass., was elected chairman of The Institute of Boiler and Radiator Manufacturers at the 35th annual meeting at the Seaview Country Club, Absecon, New Jersey, October 31, November 1 and 2. Mr. Smith succeeds W. C. Murray, president of the Utica Radiator Corp., who served two terms as chairman of the institute. Wesley J. Peoples, president of the United States Radiator Corporation, Detroit, was elected vice chairman. R. E. Ferry is the general manager and treasurer.

• On November thirteenth, the officers and directors of Buffalo Forge Co. honored Vice President Charles Arthur Booth with a formal dinner at the Buffalo Club. The affair, which was attended by department heads and out-of-town sales representatives, was in commemoration of his fiftieth anniversary with the company. Mr. Booth, a native of Massachusetts, graduated in 1899 from Worcester Polytechnic Institute. He joined Buffalo Forge Company on July 3, 1900. His main interests with the company were engineering and sales, and he was elected vice president in 1920. Mr. Booth was active in the organization of the National Association of Fan Manufacturers.

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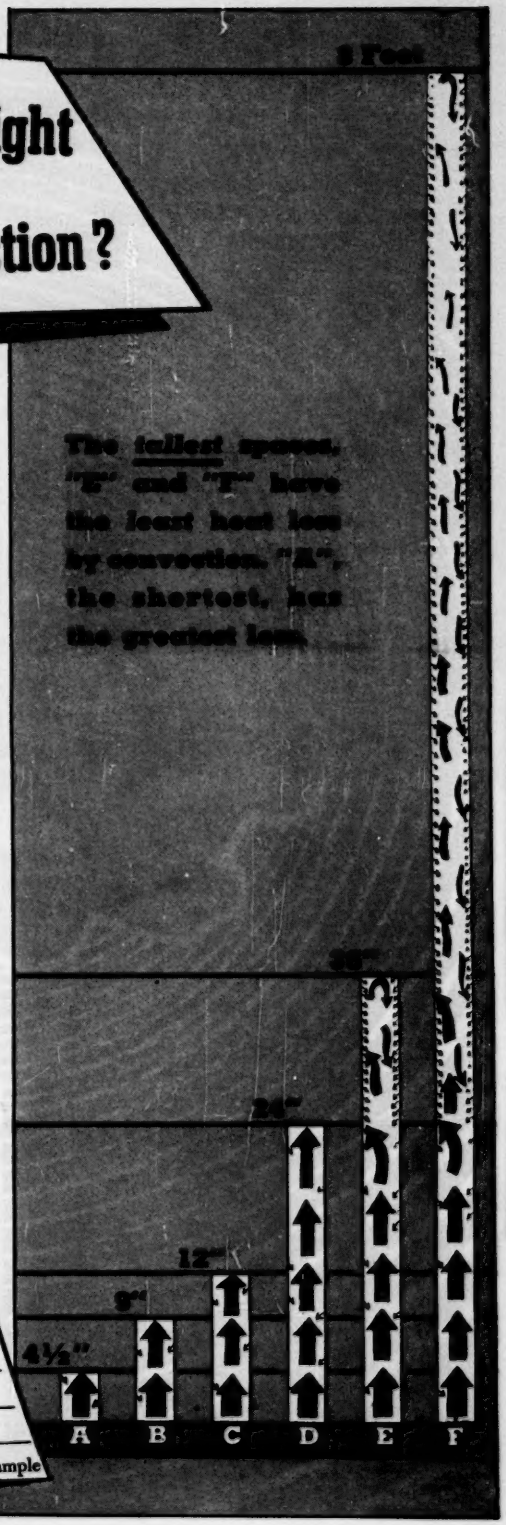
"Wall Heat Flow," a chapter in "Simplified Physics of Vapor and Thermal Insulation" describes the tests cited above. A copy of this authoritative manual may be obtained free by filling out the coupon below.



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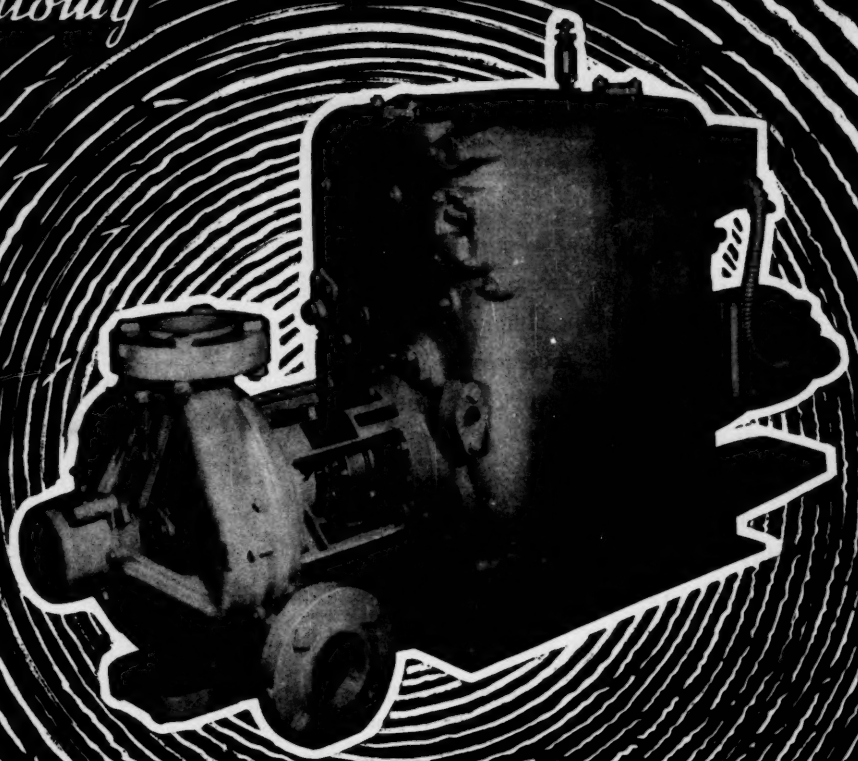

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Warm Air Forced Through Cellular Steel Floors in Exhibition Home

JOSEPH S. BOBBIO
Hyde & Bobbio, Mechanical Engineers, Detroit, Michigan

The heating system for the 1950 Detroit Builders' Show Ideal Home, described briefly as a combined radiant and convection type, is a departure from the conventional hot water and warm air systems of the past. The home itself is a modified ranch house type consisting of a first floor and basement. The heating system, using forced warm air ducted through a cellular steel flooring, is described in this report.

THE architect, in designing the Ideal Home for the 1950 Detroit Builders' Show had encouraged the use of progressive building elements and materials which had been thoroughly tested. He selected a cellular steel floor system for the first floor known as the Fenestra AD floor panel manufactured by the Detroit Steel Products Co. who suggested the idea of integrating the heating system with the floor construction itself to achieve a radiant panel system. Before selecting the floor system the architect and the general contractor had tentatively committed themselves to a forced warm air system. The heating contractor, floor supplier's engineers, and heating engineers then joined forces and evolved the system ultimately installed.

Fig. 1. 1950 Detroit Builders' Show Ideal Home.

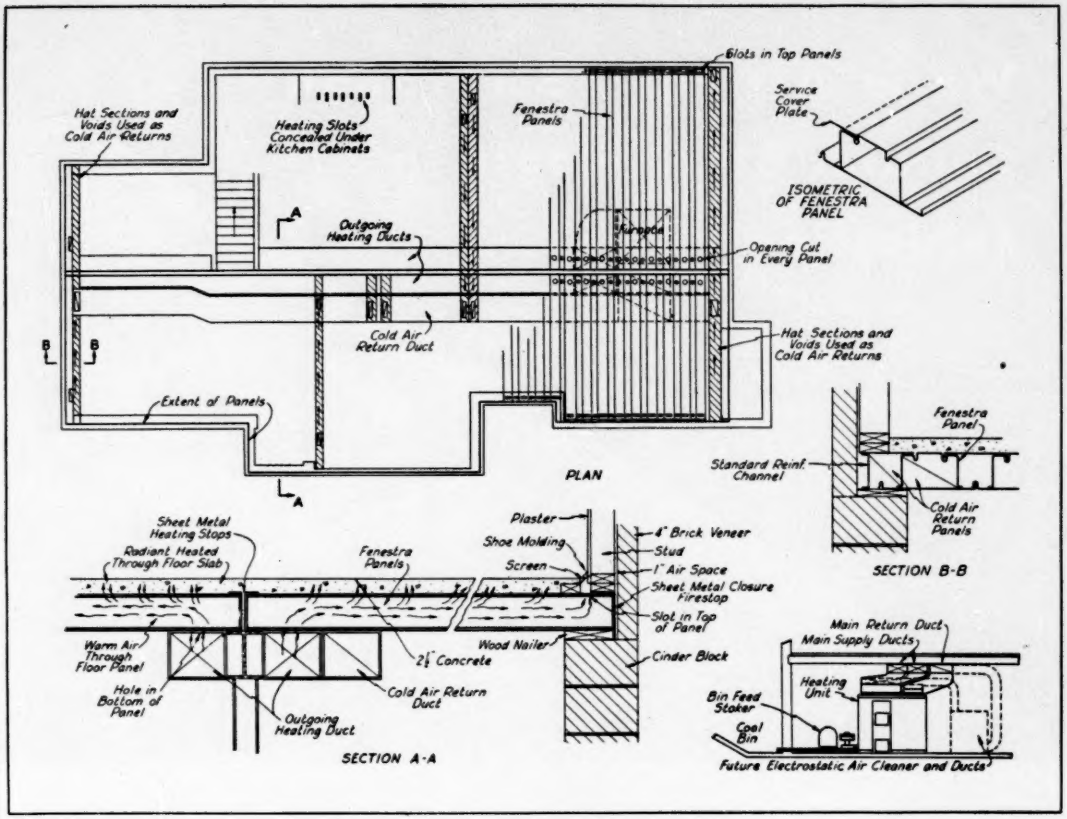


Fig. 2. Diagram of heating system of Ideal Home.

In its conventional aspects the heating system consists of a winter air conditioner serving a system of supply and return air ducts. The winter air conditioner is coal fired by an anthracite, bin-feed type stoker and ash removal unit. The application of these elements, however, varies from the traditional warm air system to produce a radiant floor in addition to the circulation of warm air throughout the building.

Air Distribution

The air distribution system is unusual, as is shown in Fig. 2. The warm air leaves the heating unit through the main supply duct which extends the full length of the home beside the main structural beam. No branch ducts leave the main; instead the air rises into the steel floor through a series of holes which are not visible. The air then flows toward the exterior walls through passages in the floor itself which approximate the joist spaces of a wood floor. In this manner the entire first floor is warmed and at the same time heat is emitted downward through the basement ceiling to warm the basement. At the exterior walls the warm air enters the rooms through a screened and slotted baseboard which is continuous through most of the rooms. In this way heat is applied at the point of maximum exposure. The air returns to the heating unit through conventional registers in each room down to a return main via return spaces also concealed in the steel floor. Dampers on the return air registers permit individual room adjustment, particularly the bedrooms. The automatic controls for the system were selected to provide practically continuous flow of heat throughout the building.

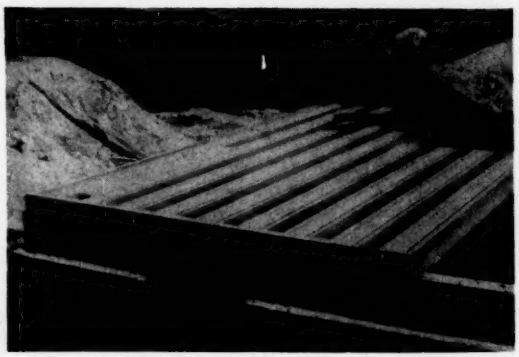


Fig. 3. Placing Fenestra AD panels in position.

The system described applies to all rooms except the living porch and bath room which are heated separately by means of radiant glass panels, mounted on the walls and thermostatically controlled.

The engineers followed conventional procedure for designing a normal forced warm air system as follows:

(1) Heat losses, using A.S.H.V.E. transmission coefficient, were made based on —10F outside and 70F inside temperature and amounted to 120,000 Btu per hr. The heated volume of the home is 20,000 cu ft.

(2) The heating unit was selected to provide 160,000 Btu per hr at the bonnet and to circulate 1,850 cfm standard air.

(3) The main supply duct was designed to provide static regain and to act as a plenum; the size was constant. The velocities through the supply system are:

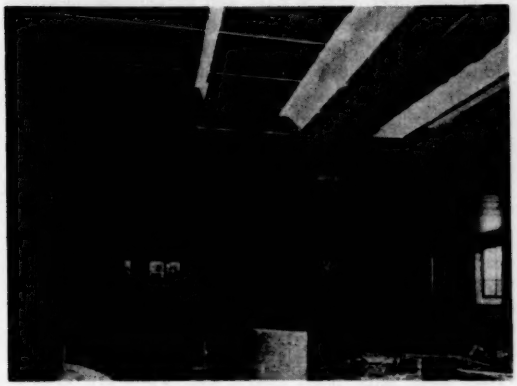


Fig. 4. Cellar during construction, showing supply and return duct fabrication.

(a) Initial main air, 1,000 fpm at 140F
(b) Final main air, 0 fpm
(c) Supply holes to floor panels, 800 fpm
(d) In panels, indeterminate and variable.
(e) Slotted baseboard, 300 fpm net at 110F.

The temperatures indicated above were estimated and based on the assumption that 50% of the heating capacity would be delivered to the building by radiation and 50% by convection.

(4) The return air system was similarly designed. Registers were used for return air to permit adjustment of air flow in the separate rooms by the occupant; dampers in the slotted baseboard were impractical. Velocities through the return system are:

(a) Inlets, 500 fpm net
(b) Slot to panel, 800 fpm
(c) In panels, indeterminate and variable
(d) In duct at heating unit inlet, 1,200 fpm.

(5) Normal automatic controls and the bin-fed stoker provide fully automatic operation of the system.

Regarding the cost of the system, it was expected that this first application would be high because of

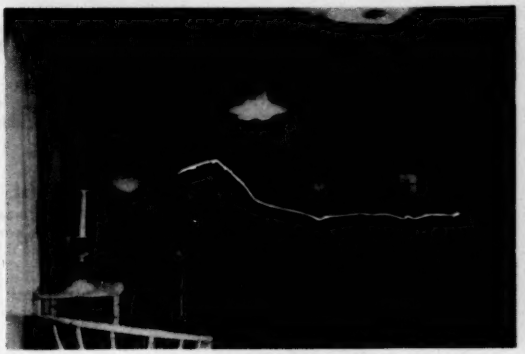


Fig. 5. Finished cellar.

(1) Experimental nature of the system.

(2) The equipment and materials selected were top quality.

(3) Being a "Show"-place, workmanship was stressed to the ultimate.

However, the knowledge obtained with this installation indicates that the cost of this heating system plus the floor panels cannot only compete with, but also better, the cost of a conventional warm air system plus a standard floor.

Preliminary conversations with the winner and present owner of the home, Mrs. Rhoda Sanderson, indicate that satisfaction with the heating system is high. She reports as follows:

(1) Her occupancy dates from the first week in March, 1950, and thus includes only a short period of cold weather.

(2) The most outstanding feature was the agreeable warmness of the floor and even distribution of the heat throughout the first floor. This would indicate that a high percentage of the heat delivered is in the form of radiant heat.

(3) The warmth of the basement which, as it is now operating, is entirely heated by downward emission from the first floor panels and main ducts. The owner indicates that she has used the basement much more than she had anticipated because of the warmth.

(4) One incident occurred which is worthy of note. As a result of a broken shear-pin the heating plant stopped. Before repairs could be made the temperature of the entire house was considerably lowered and required approximately six hours before the original conditions were attained. This would seem to indicate that additional furnace capacity is required for pick-up.

(5) As to costs of operation, the owner felt that the coal consumed for the floor system had been normal. However, she felt that the operating cost of the electric panels in the bath and living porch was excessive.

The owner has expressed a willingness to permit thorough investigation of the system next fall and winter at which time conclusive tests can be made.

Rating, Selection and Use of Panel Type Air Filters

CARL B. ROWE
Chief Research Engineer, Research Products Corp.,
Madison, Wisconsin

It is the purpose of this article (1) to point out some of the factors which should be considered in the selection and use of panel type air filters; (2) to show how air filter performance is affected by such variables as filter design, the type of dust being collected, and the test method used to get experimental data; (3) to indicate uses for typical types of commercial panel type air filters.

THE air filter is a piece of equipment designed to perform a function which on the surface appears to be a simple task. Perhaps for this reason the selecting of the proper type of equipment for various applications is not always given due consideration. The situation is further aggravated by the fact that manufacturers of air cleaning equipment do not rate their products by standardized test methods. Consequently, when the conscientious purchaser attempts to select intelligently the proper equipment for his particular application, he finds it difficult to find any common denominator to use in making comparisons.

Air cleaners used in air conditioning work can be classified into the following divisions:

(1) Electrostatic precipitators.
(2) Automatic or traveling screen filters.
(3) Panel type unit filters.

Electrostatic precipitators and traveling screen filters represent class of air cleaning equipment for special requirements. In many cases the problem involved dictates the use of this type of equipment. For the majority of air cleaning applications, however, a highly satisfactory job can be accomplished with the regular, flat, rectangular type, air filter, commonly called a panel-type filter. Consequently, this discussion will be confined chiefly to this type of equipment.

Air filters should be selected on the basis of performance, cost, durability, and available maintenance facilities. Of these factors, performance is of great importance since a filter which does not do the job is not a bargain at any price. When considering the questions of performance, cost, durability and maintenance, it should be borne in mind that there are several definite types of panel type filters on the market.

Most panel type filters can be classified as viscous impingement scrubbing type filters, straining type filters, or a combination of the two. Actually, all filters operate to some extent on a combination of the two principles.

The viscous impingement scrubbing type filter consists of a medium so constructed that the air flowing through it encounters obstructing surfaces which cause it to change its direction of flow (see Fig. 1). At each of these direction changes, dust particles impinge against adhesive-coated surfaces where they are trapped and held by the adhesive. Filters of this type are made of expanded sheet material, glass, metal or vegetable fiber, animal hair, and various combinations of expanded metal, hardware cloth and formed wire screen. A considerable quantity of dust can be collected without an appreciable change in the resistance to air flow of these filters. Viscous impingement-scrubbing type filters will remove from the air particles of dust which are much smaller than the opening in the filter. Impingement filters are generally lower in first cost and cheaper to maintain than the straining type filters.

Viscous impingement filters can be further classified as: Replaceable, light duty washable, and permanent or heavy duty washable filters.

The so-called "replaceable" filters are intended for one using, after which they should be discarded. Replaceable filters are made of expanded fiber, glass wool, steel wool, hair, plant fibers, etc. They are used in home furnaces, unit air conditioners, and ventilating systems for department stores, office buildings, etc. The market price on a 20 x 20 x 2 inch filter of this type is approximately $1.65. Designs are available in which only the filter pad needs to be replaced; 20 x 20 x 2 inch replacement pads can be purchased in the price range of 75¢.

"Light duty washable" filters are of metal construction and they are intended to be durable enough to permit cleaning and reoiling numerous times, if not handled too roughly. The uses for filters of this type are very similar to those given for replaceable filters.

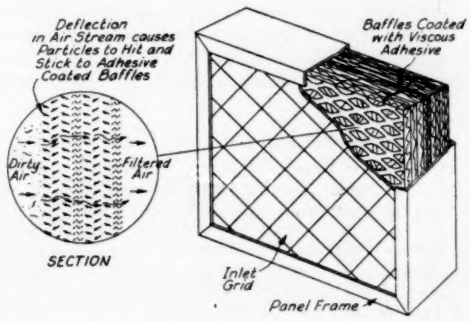

Deflection in Air Stream causes Particles to Hit and Stick to Adhesive Coated Baffles
Baffles Coated with Viscous Adhesive
Dirty Air
Filtered Air
SECTION
Inlet Grid
Panel Frame

Fig. 1. Impingement scrubbing type filter.

Their use is economically advantageous when cleaning facilities are available and the filters are not subjected to rough handling. They are of particular utility in non-standard sizes, since replaceable filters in non-standard sizes are often difficult to procure. Also in some small non-standard sizes, the detail of manufacturing processes is such that light duty washable filters are actually cheaper than throwaway filters. In these cases, the user can either discard the filter or service and replace it. A standard size 20 x 20 x 2 inch filter of this type can be purchased in the price range of $2.70.

"Permanent" or "heavy duty" washable filters are heavily constructed of expanded metal, wire screen, etc. They can be cleaned and reused indefinitely. The economic advantage of permanent filters over replaceable filters increases with the frequency of required servicing. Consequently, permanent filters are used to best advantage in the ventilating system filter banks of department stores, factories, etc., having severe dust problems and any location where frequent servicing is required. 20 x 20 x 2 inch filters of this type sell in the price range of $9.00 to $15.00.

The straining type filter is usually made up of pleated sheet material (see Fig. 2). No adhesive is used on this type of filter. From the air stream it strains particles which are larger than the openings in the filter medium. As this type of filter becomes loaded, more and more of the filter openings become clogged and the filter resistance rises rapidly. This tendency can be minimized or overcome for some types of dust by pleating the straining sheet to get a great deal of surface area. Filters of this type are often used in telephone exchanges, food processing plants and pharmaceutical houses, where high arrestance efficiency on very fine dust particles is required. Also, the large surface area obtained by pleating the medium sometimes gives advantageous dust holding capacity characteristics on some types of coarse lint.

Straining type filters can be purchased in various designs. They can be classified as replaceable type, replaceable medium type, and cleanable medium type. The panels are freqently six inches thick to permit providing enough medium surface to keep the resistance to air flow down to normal values. The selecting of the proper design is generally based on considerations of cost and available maintenance facilities.

Replaceable type straining filters usually have a medium made of paper or glass fibers held in a cardboard frame. After one using, this type of filter is discarded. A 20 x 20 x 2 inch filter of the replaceable straining type can be purchased for about $1.65.

Replaceable and cleanable medium straining type filters consist of a heavily constructed framework which is designed to hold the filter media in place and to permit replacing the media or removing them for cleaning. Replaceable media are usually made of paper, while cleanable media are made of cloth or felt. For some types of service, cleanable media can be vacuum cleaned a time or two before they are taken out and washed.

A typical 24 x 24 x 6 inch straining type panel with replaceable media can be purchased in the price range of $30.00. Material cost for replacing the media is in the range of $.25 to $.30. A typical 24 x 24 x 6 inch panel with cleanable media can be purchased in the price range of $35.00.

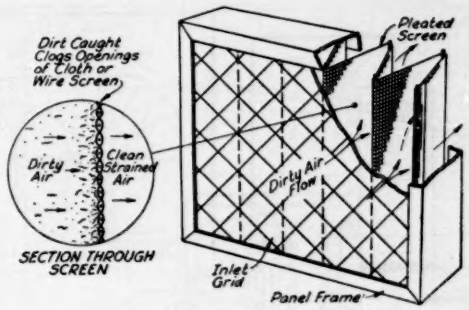


Fig. 2. Strainer type filter.

Performance

The important performance factors to consider in selecting an air filter are: (1) Clean resistance; (2) arrestance efficiency; (3) resistance build-up characteristics; and (4) dust holding capacity.

These four properties are defined as follows:

Clean resistance is the static air pressure drop across the air filter when it is clean. It is expressed in inches of water.

Arrestance efficiency is a measure of the filter's ability to catch dust. It is expressed as: (1) a percentage indicating the reduction of the weight of air-borne dust; (2) the reduction of the number of particles of air-borne dust; or (3) the reduction in the tendency of the air-borne dust to soil a surface.

Resistance build-up is a correlation of the change in the filter's resistance to air flow with the quantity of accumulated dust. It can be expressed as inches of water increase for a given quantity of accumulated dust, but it is generally shown by a curve.

Dust holding capacity is the quantity of dust accumulated during the useful service period of the filter. It is usually expressed in grams of dust.

Each of these four properties is affected by a number of variables. To select properly a specific product for a specific job, it is important that the purchaser have some understanding of how the properties are affected by the most important of these variables.

The clean resistance of a filter depends upon the velocity with which air was flowing through the filter at the time the resistance figure was obtained. Consequently, the clean resistance of a filter must be specified, together with the velocity with which air was flowing through the filter at the time the resistance figure was measured. For any specific filter, a clean resistance curve showing resistance plotted against air flow velocity can be obtained from the manufacturer. It should be kept in mind that such information is useful only to show the pressure drop across the filter when it is clean, and *it is no indication of the manner in which the resistance will increase as the dust load accumulates.*

Of all the factors considered in the selection of an

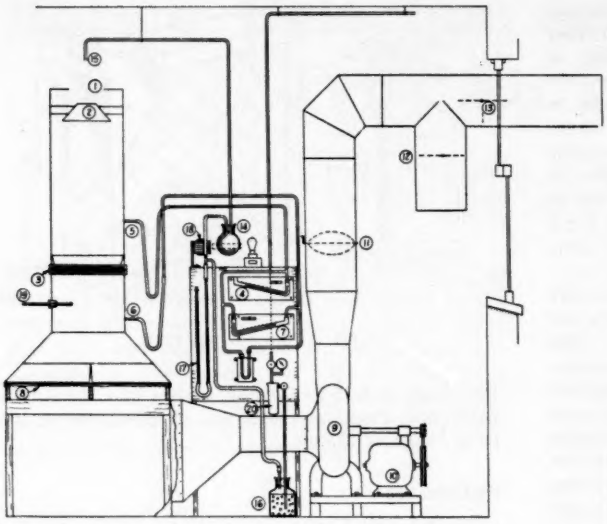


Fig. 3. Apparatus for determining weight collecting efficiency of panel type air filters.

air filter, the arrestance efficiency is the most difficult to determine and to evaluate. Arrestance efficiency is affected not only by the design of the filter but also by the test method used, the type of test dust used, and to some extent by each detail of the testing techniques.

Three basically different test methods are in use for the testing of air filters (a) the particle count method; (b) the discoloration method; and (c) the weight method. The particle count method indicates the percent by which the filter can reduce the actual number of particles in the air stream. The discoloration method indicates the reduction in the potential soiling properties of the air-dust mixture resulting from passing the mixture through the filter. The weight test method shows the percentage of the weight of the air-borne dust which can be removed (1, 2, 3).

It has been pointed out by some authorities (1) that the particle count method depends directly on the number of particles and the smallest particle influences the result as much as does the largest particle. The discoloring power of dust particles is probably influenced by the surface area of the individual particles. Since the surface area of a particle is a function of the square of its diameter, it is evident that the influence of a particle on the end result might vary with the square of this dimension. The weight of particles of a given density will vary with the particle volume. Since the volume of a particle will vary with the cube of the particle diameter, it is probable that the influence of a particle on the end result might vary with the cube of its diameter.

Large particles are usually easier to catch in a filter than are extremely small particles. Consequently, it is possible that when a test dust compounded of a wide range of particle sizes is used, a specific filter will show the best efficiency by the weight method, an intermediate efficiency by the discoloration method and the lowest efficiency by the particle count method. Actually the relationship is not this simple, and the previous relative magnitudes do not always occur (1).

A weight method efficiency probably gives a good indication of the filter's ability to remove nuisance dust of the type that settles out on floors, furniture and clothing. A discoloration efficiency is perhaps a better measure of the effectiveness of the filter in removing the dust which discolors walls, ceilings, curtains, etc. A particle count efficiency is important in evaluating the effectiveness of a filter in removing materials which are hazardous to health, such as pollen, mold spores, bacteria, or toxic dusts.

Each method has advantages and disadvantages not possessed by the others. A detailed discussion would become far too involved for the purpose of this article. However, to give the reader some idea of how efficiency figures are obtained, an apparatus used in determining "weight method" efficiencies is shown in Fig. 3. In using this apparatus, the test filter is inserted at (3). Air is drawn into the apparatus through sharp edged orifice (1) by means of blower (9) and is exhausted through dust (13). The air flow rate is regulated by means of damper (11) and it is measured by means of orifice (1) and slant gage (4). Test dust is fed into the apparatus from flask (14) by compressed air which passes through silica gel desiccator (16) and then into flask (14) where it entrains the test dust and carries it through feed tube (15). At this point it is entrained by and mixed with the air entering the test apparatus. Mixing of dust and air is improved by diffuser (2). The rate of dust feed is controlled by the magnitude of the air pressure applied to flask (14) as measured on manometer (17). A very dense straining type filter (considered as "absolute" or 100% efficient) is used at position (8). (The resistance to air flow of this filter is far too great to permit using it in practical applications.) After feeding a quantity of dust, the weight efficiency can be calculated as follows:

$$\text{Efficiency} = \frac{W}{W + w} \times 100$$

W = weight increase of test filter.

w = weight increase of absolute filter.

As stated previously, the foregoing is only one of several test methods and it can be appreciated that before efficiency figures on various filters can be compared, the prospective buyer must ascertain that the

data which he is comparing on the various products was determined by the same type of test method. At present there is, unfortunately, no generally accepted standardized test code which can be used to test air cleaning devices. However, it is encouraging to note that the air cleaning industry is cooperating with the ASHVE in the developing of a standardized code.

To illustrate the effects of filter design on filter performance in catching a specific dust and the effect on filter performance of using different dusts on a specific filter, some data obtained on a number of commercially made filters with the weight test apparatus previously described is plotted in Fig. 4 and Fig. 5.

The data of Fig. 4 were obtained with a test dust consisting of a mixture of 80% by weight of Pocahontas coal fly ash screenings which passed through a 200 mesh Tyler sieve and 20% by weight of Binney and Smith double-bolted carbon black.

The filter of curve 1 was a 2-inch thick filter made of several layers of slit and expanded sheet material coated with adhesive. The filter of curve 2 was a 2-inch thick filter made of matted fibers coated with adhesive. The filter of curve 3 was a 6-inch thick filter made of pleated dry paper. It should be noted that to obtain good arrestance efficiency without excessive resistance to air flow, it was necessary to make this filter 6 inches thick with medium pleated as in Fig. 1, while filter 1 and filter 2 were only 2 inches thick. It can be said that filter No. 1 approaches being a pure impingement filter shown in Fig. 2. Filter No. 3 approaches being a pure straining filter shown in Fig. 1, and Filter 2 comes closer to being a combination of the two types rather than specifically classifying as either one.

Curves 1, 2 and 3 of Fig. 5 show the relation of arrestance efficiency to the quantity of dust fed into the test apparatus, while curves 1-A, 2-A, and 3-A show the relation of resistance to air flow to the quantity of dust fed or the "resistance build-up."

Filter No. 1 was well coated with adhesive and its arrestance efficiency held up well until this adhesive was soaked up by the accumulated dust. The efficiency then dropped because the dust-loaded baffle surfaces had become dry and thus less effective. Because the size of the air passages through the filter were large

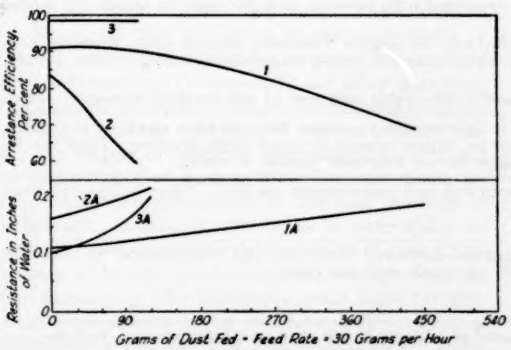


Fig. 4. Effect of filter design on performance.

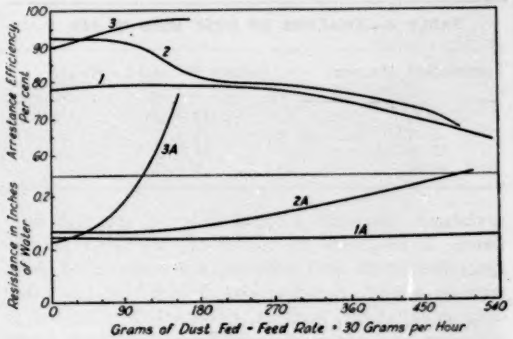


Fig. 5. Effect of dust type on performance.

relative to the size of the dust particles, the air passages did not clog and the resistance build-up of the filter as shown by curve 1-A was relatively slow.

Filter No. 2 was probably coated either with an insufficient quantity of adhesive or with a type of adhesive which did not wet through the accumulated dust. Consequently, after accumulating the first few grams of dust, the adhesive was no longer effective and the arrestance efficiency dropped rapidly. Curve 2-A shows that the resistance build-up of the filter was rapid, indicating that the accumulated dust clogged many of the air flow passages through the filter.

Filter No. 3 had no adhesive and the dust particles were caught principally by a straining action. Each dust particle caught restricted another of the filter's air flow passages. Consequently, the effective size of the passages decreased as the dust accumulated. This permitted the filter to arrest still smaller dust particles and thus its efficiency increased slightly as the dust load accumulated. Because the filter medium clogged at a comparatively high rate, a great deal of surface area was provided to prevent curve 3-A from showing an excessively rapid increased in air flow resistance. To accomplish this, this filter was made 6 inches thick rather than the 2-inch thickness used with the impingement filters.

The dust holding capacity of a filter, as previously defined, can be given as the quantity of dust accomulated either before the filter's resistance to air flow exceeded a specified maximum or before its

TABLE 1—DUST HOLDING CAPACITY OF THREE FILTERS

Filter No.	*Dust Holding Capacity, Grams	
	Before Resistance Reached .2 Inches w.g.	Before Efficiency Dropped to 80%
1	374 +	260
2	66	16
3	120	∞

*For purpose of convenience, the air flow resistance and arrestance efficiency figures are frequently plotted against the quantity of dust fed to the filter rather than the quantity of dust accumulated by the filter. To get dust holding capacity figures from Fig. 4, it is necessary to multiply values read from the "Grams of Dust Fed" scale by the average arrestance efficiency.

TABLE 2—ANALYSIS OF DUST USED IN FIG. 5

Particle Size, Microns	Percent of Total by Weight
0-5	39 ± 2
5-10	18 ± 3
10-20	16 ± 3
40-80	9 ± 3

arrestance efficiency dropped below a specified minimum. A maximum air flow resistance figure (at 350 fpm) frequently used is .2 inches w.g. for small units, such as a home furnace; and .5 inch w.g. for heavy duty installations, such as industrial filter banks. A minimum arrestance efficiency figure for 2-inch filters on the test dust used in Fig. 4 might be set at 80%. On this basis, the dust holding capacity of the filters of Fig. 4 will be as shown in Table 1.

The data of Fig. 5 were obtained by testing a viscous impingement filter of a design very similar to that described as filter No. 1 of Fig. 4. Curves 1 and 1-A show arrestance efficiency and resistance build-up data obtained when testing with Arizona road dust fractionated into sizes as shown in Table 2. (Dust No. 1).

Curves 2 and 2-A show the arrestance efficiency and resistance build-up data obtained when testing with a test dust consisting of 80% by weight of Pocahontas coal fly ash screenings which passed through a 200 mesh Tyler sieve and 20% by weight of Binney and Smith double-bolted carbon black. (Dust No. 2).

Curves 3 and 3-A show the arrestance efficiency and resistance build-up data obtained by using a test dust consisting of 95% by weight of the dust mixture used in obtaining curves 2 and 2-A and 5% by weight of Kapok lint produced by grinding Kapok linters for 20 min in a ball mill and then taking the screenings which passed through a 20 mesh Tyler sieve. (Dust No. 3).

TABLE 3—GENERAL TYPES AND CHARACTERISTICS OF PANEL FILTERS

Filter Design	Typical Applications	Typical Characteristics
Viscous impingement filters.	Filter banks in department stores, theaters, office buildings, etc.	Relatively inexpensive in first cost.
	Home furnaces.	Relatively inexpensive to maintain.
	Unit air conditioners.	Has good resistance to clogging by dust encountered in most applications.
		Has good average arrestance efficiency for dust encountered in most applications.
Dry type straining filters.	Filter banks in food processing plants, telephone exchanges, pharmaceutical houses.	Has good efficiency on very fine dust.
		Efficiency tends to increase as filter loads.
		Large surface area sometimes gives good holding capacity for some types of lint.

Dust No. 1 is a comparatively fine heavy dust. Since the fine particles are generally more difficult to arrest, the inclusion of the fine particles tend to reduce the filter's maximum efficiency. However, a given weight of the heavier dust does not clog as many air passages and probably does not soak up as much adhesive as does the same weight of a bulky dust. Consequently, both the rate of air flow resistance build-up and the rate of arrestance efficiency decrease are influenced by the "bulk" of the dust caught.

Dust No. 2 is coarser and lighter than dust No. 1.

TABLE 4—SELECTION CRITERIA FOR PANEL FILTERS

Filter Type	Typical Considerations Predicating Choice
Panel type viscous impingement replaceable.	Choice of replaceable filters usually based on considerations of first cost, maintenance costs and maintenance facilities. Filter is replaced after one using.
Panel type viscous impingement. Light duty washable.	Economically advantageous where cleaning facilities are available and where filters are not subjected to rough handling. Filter is cleaned, recharged with adhesive, and put back in service for limited number of times.
	Very advantageous for use by manufacturers as original equipment in units using filters of non-standard sizes. Solves customer service problem of having to locate replaceable filters of non-standard size.
	First cost of non-standard sizes frequently comparable with that of non-standard throwaway filters.
Panel type viscous impingement. Heavy duty washable.	Economically advantageous where air is dusty enough to require frequent filter servicing, if cleaning facilities are available and filter must be rugged enough to stand rough handling. Filter can be be cleaned and recharged with adhesive for an indefinite number of times.
Panel type dry straining replaceable filter.	Choice based on first cost, maintenance cost and maintenance facilities. Filter is replaced after one using.
Panel type dry straining filter with replaceable media.	Used where frequency of servicing justifies additional first cost and maintenance facilities are available for replacing media. Media replaced after one using.
Panel type dry straining filter with cleanable media.	Used where frequency of servicing justifies additional first cost and maintenance facilities are available for cleaning media. Media can be vacuum cleaned or washed.

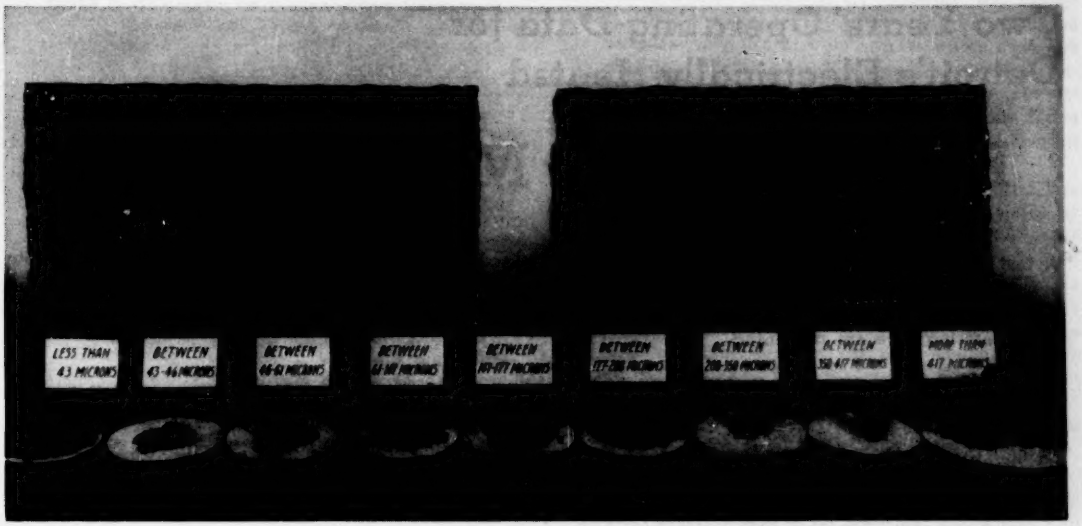


Fig. 6. Size and quantity analysis of dust from two filters in an apartment house furnace.

The coarser particles probably account for obtaining a higher maximum efficiency than was obtained with dust No. 1. When using dust No. 2 rather than dust No. 1, the maximum arrestance efficiency drops off at a more rapid rate and the resistance to air flow builds up more rapidly. These effects can probably be explained as due to the absorbing of more of the filter's total quantity of adhesive by a given weight of bulkier dust and to the clogging of more of the filter's air passages by a given weight of bulkier dust.

The addition of lint to dust No. 2 makes it still coarser and bulkier. These coarse particles increase the filter's maximum efficiency. The coarse lint particles clog the filter's air passages to the point where it becomes a straining filter and exhibits the straining characteristics of rising arrestance efficiency and rapid resistance build-up.

Performance figures obtained by the use of test dusts provide a common denominator to use in comparing various air cleaners. However, they can be criticized on the ground that when a filter is in use, the dust which it collects may be vastly different in composition than was the test dust. The curves of Fig. 5 indicate that variations in the composition of the dust have a substantial influence on the resulting filter performance. Consequently the filter purchaser should use all of the information he can gather on the nature of the dust concerned in his particular problem, the degree of cleaning perfection required and the performance of various filters on test dusts approximating the composition of the dust involved in his problem. In general, dust borne in recirculated air is likely to contain substantial quantities of coarse lint, together with finely divided carbon and silica dust, etc. Most commercial filter banks and most home furnaces handle high percentages of recirculated air. Industrial process dusts, and the dust load of outside air might be comparatively lint-free. Fig. 6 shows the dust which was extracted from two commercial filters after they had been in use in an apartment house furnace for about three months. This dust was removed by means of a solvent which dissolved the adhesive and thus freed the dust. The dust was then separated into components by means of a set of Tyler sieves. This dust consisted largely of lint down through the 61 micron size.

To act as a rough guide in selecting various filter products for specific jobs, the accompanying tables were compiled.

Table 3 shows the two basic designs of filters with typical uses indicated for each, together with typical characteristics which adapt the filter to the uses indicated. Because of the great variation in the type of dust found in different locales, there is a great deal of overlapping in the applying of types of filters to types of operations. Consequently, Table 3 serves more as an illustration, rather than a specific recommendation.

After the basic design of the filter has been selected, the decision of whether to use a throwaway type or some type requiring a greater initial investment, depends on an intelligent consideration of first costs, maintenance costs and available maintenance facilities. Table 4 lists several types of panel-type viscous impingement filters and dry straining type filters, together with brief suggestions of factors to be considered in making a choice.

Bibliography

(1) Rowley, F. B., and Jordan, R. C., A Comparison of the Weight, Particle Count and Discoloration Methods of Testing Air Filters, *ASHVE Transactions*, Vol. 47, 1941, p. 29.

(2) A.S.H.V.E. Standard Code for Testing and Rating Air Cleaning Devices used in General Ventilation Work, *ASHVE Transactions*, Vol. 39, 1933, p. 225.

(3) Dill, R. S., A Test Method for Air Filters, *ASHVE Transactions*, Vol. 44, 1938, p. 379.

Two Years' Operating Data for Detroit's Electrically Heated

Highway Snow Melting System

A test section of an electrically heated snow melting system installed in a suburb of Detroit, Mich., has been in operation for two winter seasons. Cost and operating data are presented.

TWO test snow melting installations on Eight Mile Road at Ferndale, a suburb of Detroit, Mich., have been in operation for several seasons with satisfactory results. Figures have been released on the snow melting operations of these systems for the season of 1949-1950 which is considered to be close to the average winter season. The 1948-1949 season only had a total snowfall of 10.3 inches as compared with a total of 41 inches for the past snow melting operating period. Aside from actual snowfall, the city often gets an icing condition with a light mist or freezing in the early spring or late fall.

The test systems are installed on a divided highway. The north roadway has a concrete surface and the south roadway a bituminous surface, so that results with two types of road construction are available. Each test section is 500 ft long and is located in the inside lane. Fig. 1 shows the electrical circuit.

While most snow melting systems are served by hot water or low pressure steam, these installations have electrically operated heating elements. H. F. Wall, Assistant General Superintendent, Detroit Public Lighting Commission, points out that the cost of electric snow melting is high and it should not be attempted except where the benefits derived more than offset the costs.

Heating Elements

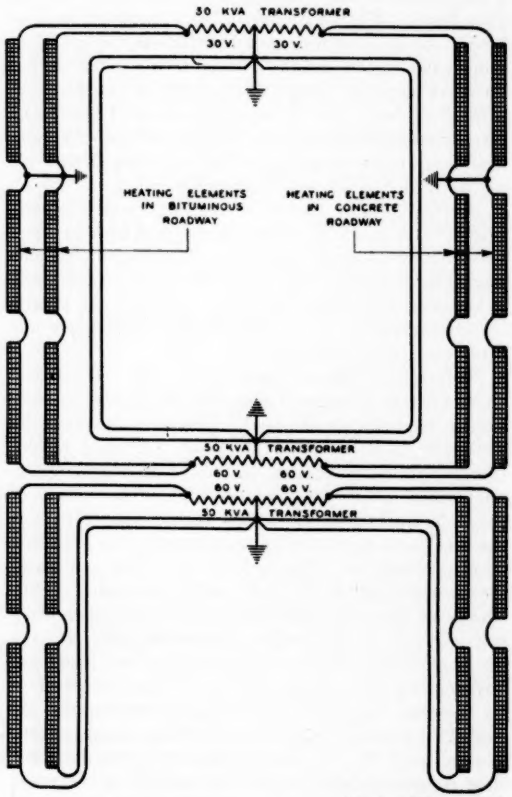
Each system uses heating elements consisting of 2x2-inch standard concrete sidewalk reinforcing mesh, composed of No. 14 gage galvanized iron wire, 18 inches wide. It was necessary to use this length, for the pavement joints are at 99-ft intervals. At the end of each heating element, a ¼x2-inch copper bar and terminal wires were brazed to permit connection to the source of power. The heating elements were placed two inches below the surface in the concrete roadway and 1¼ inches below the surface of the bituminous roadway. The heating elements were given an insulating varnish coat to eliminate possible electric shock to persons or animals.

Controls permit the heating elements to be energized when the temperature approaches 36F, and shut off when the temperature reaches 38F.

While the snow melting system in the bituminous roadway functioned well last season, there was some trouble with the controls for the other system. This was corrected and the power input for the concrete section was increased on February 22, 1950, from 52 watts to 62 watts per square foot of heating element.

Operating Costs

The cost per hour to operate the two 500-ft sections was $1.89 as against $1.31 for the 1948-1949 season. The cost for power consumed for the entire installation was $1,041.02, which is within the estimate range predicted for a normal winter snowfall of about 40 inches. Power consumption for the bituminous roadway was 5% greater than that for the concrete section due, it is believed, to the difference in cover over the heating elements in the two sections, and to the respective



Courtesy, Wagner Circle

Fig. 1. Layout of the Eight Mile Road test highway heating strip, at Ferndale, a suburb of Detroit, Mich.

TABLE 1—SUMMARY OF COMPARATIVE OPERATING DATA FOR TWO SEASONS

Item	1948-49	1949-50
Total time "on", hours	506.69	548.79
Total kwh consumption	28,830	46,640
Concrete section	13,810	22,780
Asphalt section	15,020	23,860
Total cost (DPLC rate), dollars	663.42	1,041.02
Concrete section	319.66	507.24
Asphalt section	343.76	533.78
Energy consumption, kwh, per 500 ft section per hour of operation:		
Concrete section	27.3	41.5
Asphalt section	29.7	43.5
Energy consumed, watts, per 500 ft section per hour per sq ft of heating surface:		
Concrete section	18.4	27.9
Asphalt section	20.0	29.3
Cost, dollars, per 500 ft section per hour of operation:		
Concrete section	0.63	0.92
Asphalt section	0.68	0.97
Cost of system per hour of operation	1.31	1.89
Total Snowfall, inches	10.3	41.0

relative thermal conductivity of the bituminous and concrete pavements.

While the pavement heating installation was designed to be used for areas which would have the necessary run-off facilities for handling the melted snow, the pavement grade of the present installation is comparatively flat and no special water drainage is provided. Water, therefore, tends to form an insulating layer over the heated areas, thereby preventing an efficient transfer of heat to the freshly fallen snow. This imposes an added burden on the heating installation.

The two installations were installed by the Michigan State Highway Department and power is supplied by the Detroit Public Lighting Commission. The power consumed per 500-ft section per square foot of heated area is about one-half of the design value of 52 watts for the bituminous section and the present 62 watts for the concrete section. This indicates that the heating elements were on for only one-half of the operating time.

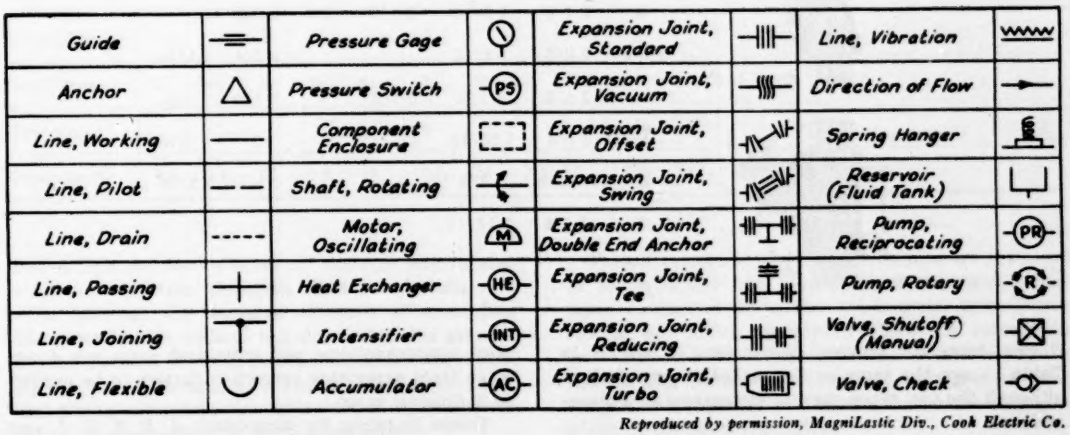
These snow melting installations are part of a cooperative research project between the Michigan State Highway Department, which made the installation, and the Detroit Public Lighting Commission.

Table 1, which summarizes operating data for two seasons, presents figures for a normal winter and also for one when the snowfall was considerably below normal. This information is taken from Report 152 of the Research Laboratory Testing and Research Division, Michigan State Highway Department.

Drafting Room Symbols for Piping

Although there are standard drafting room symbols for certain phases of piping, the standards are not too complete. For that reason, and to simplify the preparation of piping drawings, especially where expansion joints and associated equipment are involved, engineers of the MagniLastic Division of Cook Electric Company, Chicago, have developed the accompanying group of symbols, presented here by permission. This company, which manufactures expansion joints, believes that use of these symbols by engineers and contractors will lead to better understanding in preparing and interpreting piping drawings.

These symbols, which have been designed for pipe fittings, heat transfer equipment, pumps and valves, are not too difficult to employ on drawings. The engineers who designed these symbols believe that they will simplify the diagramming of piping layouts and help clarify presentation of information.



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Standard Cast Iron Pipe Fitting Allowances

RICHARD IRMITER

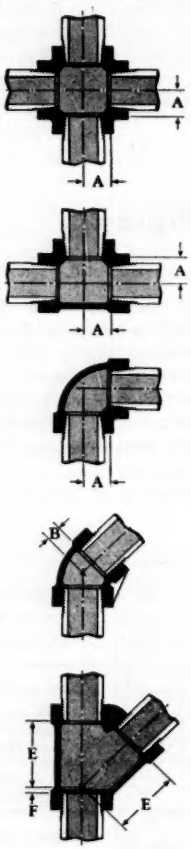
Supplementary to tables published in the May, 1950, issue covering dimension allowances for standard malleable iron fittings, tables are presented to show piping measurement allowances for cast iron fittings.

IN tables for determining pipe lengths between standard cast iron fittings, where accurate center-to-center measurements are desirable, allowances for elbows, tees, and crosses (dimensions *A* and *B* in Table 1) are the same as for malleable iron fittings although the two types vary in dimensions and cross-section.

Dimensions given are based on commercially perfect pipe and fittings installed under ideal conditions. Therefore, the figures given should be regarded as close approximations, and individual users can determine from experience correction factors to be applied in individual cases.

Values in tables for dimensions *A*, *B*, *E*, *F*, *J*, and

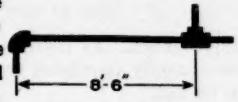
TABLE 1. STANDARD CAST IRON FITTING ALLOWANCES FOR PIPE MEASUREMENTS



Pipe Diam.	Dimension Shown at Left				Close Nipple Length	Thread Engagement
	A	B	E	F		
	Inches					
1/4	7/16	3/8			7/8	3/8
3/8	9/16	7/16			1	3/8
1/2	5/8	3/8			1 1/8	1/2
3/4	3/4	7/16	1 11/16	3/16	1 3/8	9/16
1	13/16	7/16	2 1/16	1/16	1 1/2	11/16
1 1/4	1 1/16	5/8	2 9/16	5/16	1 5/8	11/16
1 1/2	1 1/4	3/4	3 1/8	3/8	1 3/4	11/16
2	1 1/2	15/16	3 3/4	1/2	2	3/4
2 1/2	1 3/4	1	4 1/4	5/8	2 1/2	15/16
3	2 1/8	1 3/16	5 1/8	3/4	2 5/8	1
3 1/2	2 3/8	1 5/16			2 3/4	1 1/16
4	2 5/8	1 1/2	6 1/2	1	2 7/8	1 1/8
5	3 1/4	1 13/16			3	1 1/4
6	3 13/16	2 1/8			3 1/8	1 5/16
8	5 1/8	2 13/16				

K are distances from the center-line of the fitting to the end of the pipe screwed into the fittings. In piping layout, the actual length of pipe between two fittings is the center-to-center distance between fittings less the tabulated value for each fitting.

Example: The center-line distance between a tee and a 90-degree elbow in a 3-inch line is 8 ft 6 inches. According to Table 1, the distance to subtract for the elbow is 2⅛ inches. The same for the tee. The total distance to subtract is 4¼ inches, leaving an actual pipe length of 8 ft 1¾ inches.



Straight or sleeve couplings, unions, and street elbows are made in malleable iron only. Allowances for these fittings were given in the previous article in the May, 1950, issue. The reader is referred to that article also for a discussion of nipple lengths and a chart to facilitate 45-degree offset calculations.

To calculate the diagonal distance between two 45-degree fittings without the chart when the perpendicular distance between center-lines is known, multiply the known distance by a factor of 24/17 or 1.412. The fitting allowances are subtracted from the result to give the actual length of diagonal pipe.

Example: A vertical 2-inch pipe is to be offset 45 degrees using an elbow and a Y-bend. The horizontal distance (*a*) between center-lines must be 2 ft 8 inches (32 inches). The diagonal distance (*b*) between center-lines will be 32 x 1.412 = 45.244 inches or 3 ft 9¼ inches. The fitting allowance for the Y-bend from Table 1 is 3¾ inches, and for the elbow is 15/16 inch. The sum of the fitting allowances, 4 11/16 inches, is subtracted from the diagonal distance between center-lines to give an actual diagonal pipe length between fittings of 3 ft 4 9/16 inches.

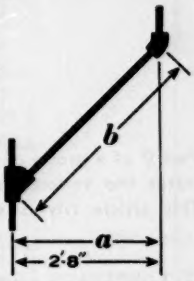
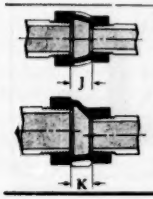


TABLE 2—STANDARD CAST IRON REDUCER COUPLING ALLOWANCES FOR PIPE MEASUREMENT



Large Pipe Diam.	¾	1		1¼		1½			2				2½			
Small Pipe Diam.	¾	¾	¾	¾	1	¾	1	1¼	¾	1	1¼	1½	1	1¼	1½	2
Dimension J	7/16	½	⅝		¾					1	1	1				1⅛
Dimension K				⅝	¾	1	⅝	⅝	1½	1	1	1	1 7/16	1 7/16	1 7/16	1

Large Diam.	3					3½						4						
Small Diam.	1	1¼	1½	2	2½	1	1¼	1½	2	2½	3	1	1¼	1½	2	2½	3	3½
Dimension J				1⅛	1⅛										1½	1 7/16	1¼	
Dimension K	1¼	1¼	1¼	1 7/16	1	1⅛	1⅛	1⅛	1 7/16	1¼	1 7/16	1 7/16	1 7/16	1 7/16	1½	1 7/16	1¼	1 7/16

Large Diam.	5					6						8						
Small Diam.	2	2½	3	3½	4	2	2½	3	3½	4	5	5	6					
Dimension J					1½					1 15/16	1 15/16		2½					
Dimension K	1⅛	1 13/16	1⅛	1 7/16	1½	2 7/16	2⅛	2 7/16	2	1 15/16	1 15/16	2 7/16	2⅛					

Thread engagements for cast iron pipe are the same as for malleable iron pipe. Thread engagement distance subtracted from the end-to-center-line dimension of any fitting or valve will give the amount to be subtracted from the pipe-line measurement in determining actual pipe length. Examples of this method, for fittings not shown in the tables, were given in the previous article.

Methods for Supporting Pipe

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Part 9 of a group of articles that describes and illustrates the various means for supporting pipe lines. This article covers supports for piping in tunnels.

HOSPITALS, educational buildings, etc., frequently consist of several buildings which are supplied with steam, hot water and refrigeration from a central source. These buildings generally are located at some distance from each other and the central service building. Obviously, the piping between these buildings cannot be run above ground, as might be done with a group of industrial buildings, and therefore pipe tunnels are provided.

Pipe tunnels are expensive and, in order to keep down the cost, they must be kept small and yet permit installation of the piping with the necessary valves, fittings, expansion joints, supports and anchors, and space provided for passage between buildings, inspection and servicing of the piping. The tunnels may be short and straight, or they may be long and require changes in direction that do not match with standard fittings. They may also be reasonably level, or have to be pitched slightly or steeply. In some cases, the pitch may be in the wrong direction for the piping system requirements. As these tunnels generally can only be conveniently ventilated from the ends, they are liable to be hot.

When designing a tunnel piping system, all of these things must be considered and the method of supporting, anchoring and guiding the pipes must be very carefully studied.

When there are several services to be run through a tunnel, it generally is necessary to rack these lines along one or both walls of the tunnel leaving space at one side or in the middle for a passageway. It is usually not desirable to have more than two large lines run at the same level on the same side of the tunnel because of the difficulty of obtaining access to work on the lines next to the wall. The number of pipes high will be governed by the height of the tunnel, the size of the pipe, the vertical space required between pipes to accommodate the supports, and any additional space required because of the necessity of pitching pipes in opposite directions, as is common in the case of steam and return lines.

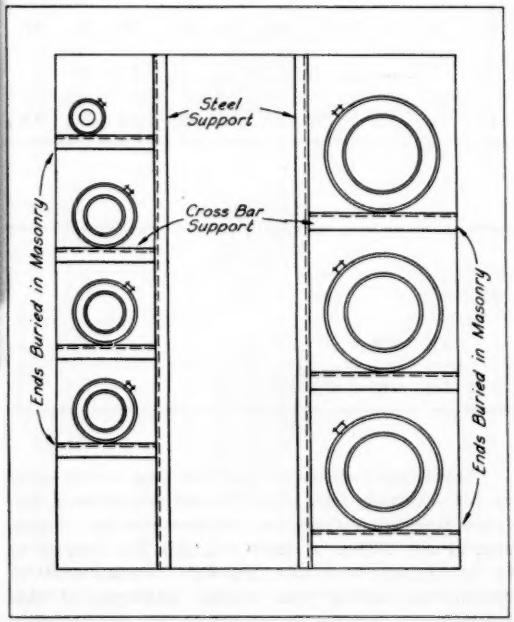


Fig. 126. Method of supporting pipe lines in a tunnel.

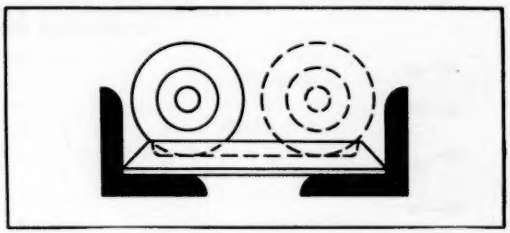


Fig. 127. Angle-irons used as cross support for pipe.

Additional space may be required for installation and maintenance of either bellows type or sliding type expansion joints. If expansion bends are used, the piping can generally be so arranged that no crossing of pipes is necessary to accommodate these bends.

It is generally considered desirable that any pipe may be temporarily or permanently removed without affecting other lines and each pipe should therefore be independently supported.

One method frequently used consists of the installation of vertical structural steel supports at intervals of about 10 ft with angle-iron cross-bar supports welded to these vertical supports at one end and buried in the masonry at the other end, as shown in Fig. 126. If the pipes are not subject to movement or excessive vibration and do not require any special pitch they may just rest on the horizontal supports with clamps at only every fourth or fifth support to prevent the pipe being accidentally moved when working on adjacent pipes. If the pipes are subject to longitudinal

movement because of expansion, pipe rolls and plates may be provided at the points of support and, in order to keep the vertical space required between pipes to a minimum, the cross supports may each consist of two angle-irons with the flanges at the bottom and the pipe roll and plate supported on the flanges, as shown in Fig. 127. If vertical adjustment is necessary to permit proper grading of the pipe lines, an adjustable pipe roll stand with baseplate may be used.

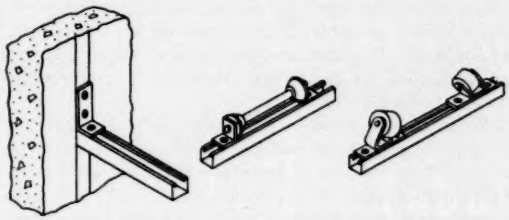


Fig. 128. Special structural supports for piping in tunnels.

To simplify and reduce the cost of installation of structural steel supports for tunnel piping as described, the Unistrut Products Co. furnishes special structural steel framing with spring nuts, angle clips, roll supports, etc., as shown in Fig. 128, which can be readily installed and adjusted to provide the right pitch or slope with no other tools than a hacksaw and a wrench.

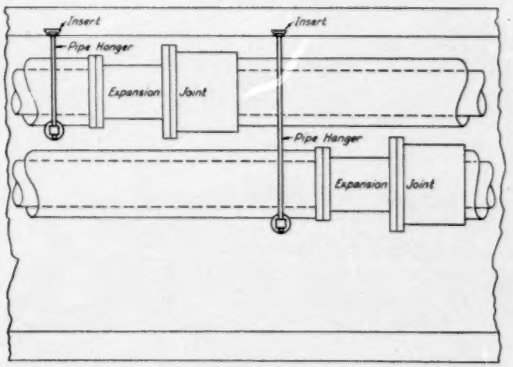


Fig. 129. Two-rod roll type hangers for supporting pipe in tunnels.

Tunnel piping may be supported by means of two-rod roll type hangers suitably spaced to eliminate interference, as shown in Fig. 129. Anchors in this case can be integral with the expansion joints and can be bolted to the masonry walls. Pipe alignment guides can also be bolted to the wall.

The method of installing vertical roller guides with structural steel supports is shown in Fig. 130.

The covering on steam and hot water lines is frequently cut at the points of support, especially where roll type supports are used in order to provide solid

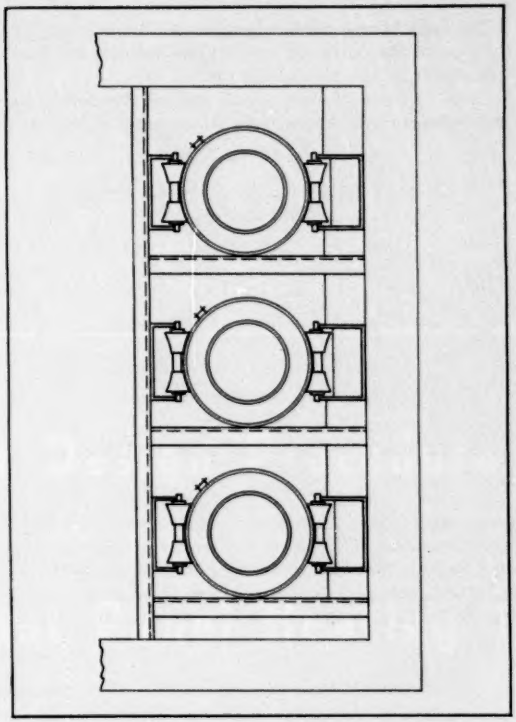


Fig. 130. Method of installing vertical roller guides in connection with structural steel supports.

support for the pipe. This results in excessive heat loss from the pipes at these points, which is wasteful, and also may cause excessive tunnel air temperatures. The covering for refrigeration lines must always be continuous.

Pipe covering protection saddles, Fig. 131 and 132, are frequently provided to permit continuous insula-

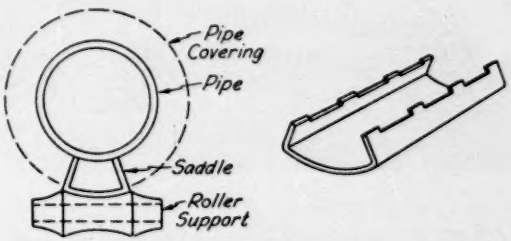


Fig. 131. Pipe covering protection saddle for 10-inch pipe and smaller.

tion of steam lines. These consist of heavy curved steel plates concentric with the pipe for which they are to be used and about 12 inches long. The side edges are turned up and a center plate is welded in for 12-inch pipes and larger. The saddles are filled with plastic cement or sectional covering cut to suit before being installed.

The use of these saddles provides a solid support for the pipe at the points of support and reduces the heat transfer from the pipe to the tunnel.

Tests to prevent excessive tunnel air temperatures and excessive heat losses from steam pipes at the supports, made under the direction of Gordon V. Carlson, Superintendent of Utilities, University of Illinois, also disclosed the fact that in existing tunnels many of the roller supports remained stationary instead of revolving while the pipe slid over them. As a result of these tests it was decided to use 16 gage sheet metal bands 18 inches long applied on the outside of the covering which would provide adequate support for the pipes, and allow them to rest directly on the 10-inch supporting channels, without rollers, as the wear due to movement of the pipe would be negligible.

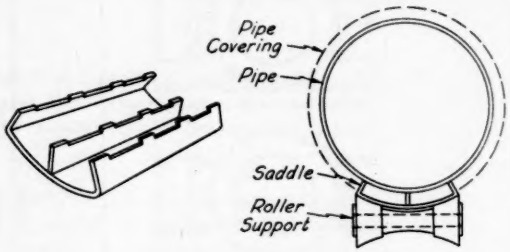
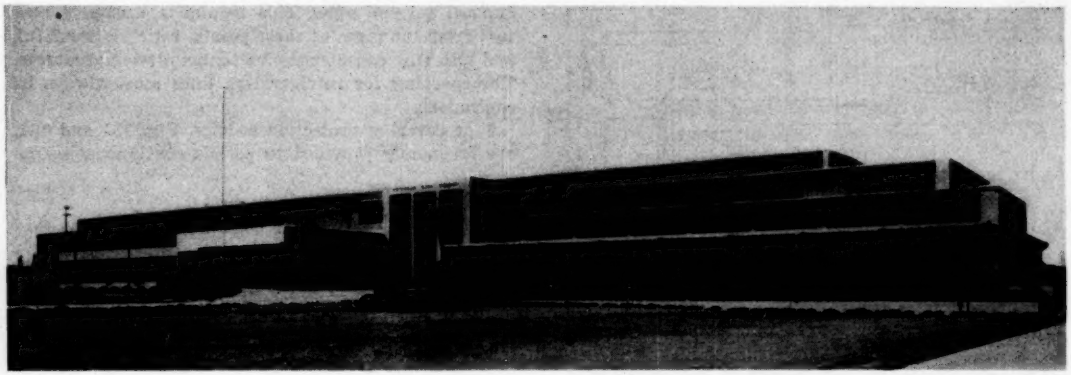


Fig. 132. Pipe covering protection saddle for 12-inch pipe and larger.

Further developments by Sargent & Lundy indicate that it is advisable to provide sufficient length of shield to limit the load to approximately 100 lb per linear inch of line with 85% magnesia, and, in certain cases, depending upon the insulation manufacturer, to use a denser material than normal on the lower half of the supporting section. This type of support is not recommended for use on pipe bends as it is very difficult to form the shield.

When the piping is to be supported by a hanger, a 10 gage steel plate of suitable length is used which is rolled into a band to fit the insulated pipe and is provided with a flange for assembly. A saddle plate ⅜ inch thick is then tack welded around the lower half of the flanged band to assist in carrying the direct load and in spreading it over a wide area. The unit is then bolted in place around the insulated pipe, a filler bar is fitted over the upper half of the flanged band and a usual hanger strap is fastened around the entire assembly.

Floor Panel System Serves California High School

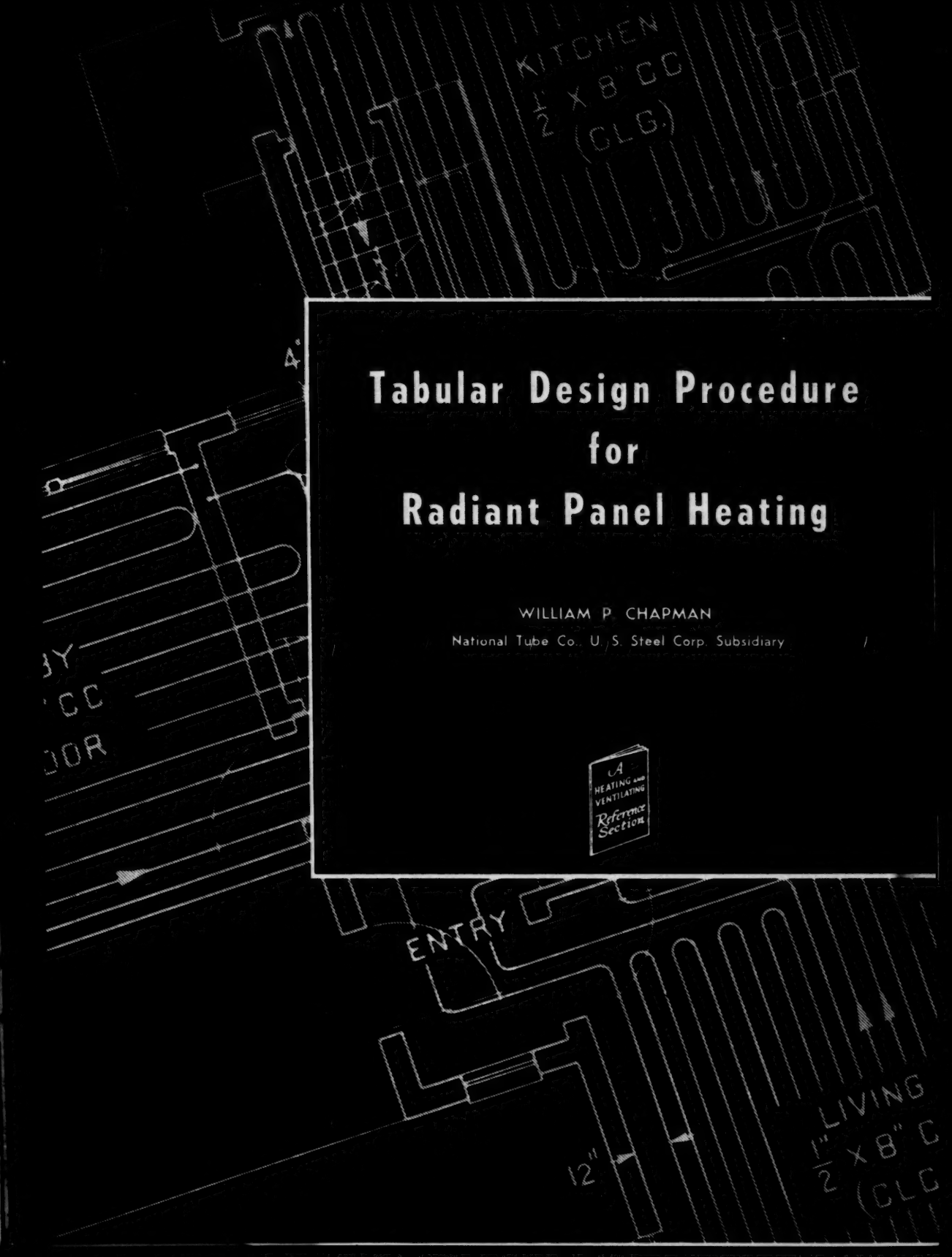


There are approximately 20,870 linear feet of steel pipe in the floor panel radiant heating system of Rosemead High School, Los Angeles, Calif.

The building is zoned by rooms, with each room controlled by an air temperature actuated thermostat operating a water pump in the centrally located boiler rooms. These pumps are all high-flow, low-velocity type and are designed to deliver 90 gpm against an 8.5-ft head. Balancing within the zones is achieved by manually adjusted valves.

Input water temperatures are controlled at 120F by boiler thermostats, with the return water averaging 100F. Floor emission to handle anticipated outside air temperature range from 70F maximum to 30F minimum has been designed to deliver 72 Btu per sq ft of floor area. Maximum allowable surface temperature is 82F.

Architects were Kistner, Curtis and Wright, Los Angeles, Calif.; heating system was designed by Chester Wald, chief mechanical engineer for the architects; heating contractor, Ray Engineering, Los Angeles; general contractor, R. H. Parr & Son, Los Angeles. Steel pipe, Rayduct, product of Bethlehem Pacific Coast Steel Corp.



Tabular Design Procedure for Radiant Panel Heating

WILLIAM P. CHAPMAN
National Tube Co., U. S. Steel Corp. Subsidiary

Tabular Design Procedure for Radiant Panel Heating

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Use of the author's rational procedure for radiant panel heating design, which has been described in previous issues of Heating and Ventilating, has been facilitated by a convenient tabular compilation of thousands of solutions to the single design equation upon which the system is based. This Reference Section is an introduction to the tabular method and includes tables sufficient for design at zero F outside temperature, residential and commercial comfort conditions, and floor, wall, or ceiling location of panels. An appendix shows development of basic equations. A complete tabular compilation of solutions is offered by National Tube Company in a booklet, "Radiant Panel Heating Supplement," covering design conditions from −20F to +30F with panels located in floor, wall, or ceiling under both residential and commercial comfort conditions.

ALTHOUGH one form of radiant heating was first installed about 2,000 years ago, it has been just about 10 years ago since engineers started to analyze the heat transfer from a modern radiant heating panel. In the ten-year period, ideas have been presented with incredible rapidity. Probably no heating innovation has been so fortunate; never before have so many engineers focused their attentions on one subject in such a short time.

The result has been some confusion and conflict of opinion, of course. So many ideas, design procedures, claims, and arguments have been presented, that most theories have been ignored. Now, however, new theories are not presented as frequently and it is possible to summarize and cull the hundreds of presentations.

Probably the most obvious observation is that all the design procedures are in good *general* agreement; that is, for average construction and thermal load, results from several design procedures lie within engineering accuracy. This condition has lengthened the period of confusion because no one procedure could be pointed out as superior to all others.

Some day, however, one design procedure will be recommended and accepted as superior. At that time, radiant heating will be considered as simple to design as any other heating system. Until then, though, radiant heating systems will be installed and engineers will design with various procedures.

After the observation that all design procedures are in general agreement, there are few statements concerning radiant heating that an engineer can confirm. Fortunately, there has been sufficient interest in radiant heating to encourage considerable research and study.

At the present time, there are theoretical analyses or laboratory investigations being carried out on all known phases of the remaining problems. We will discuss here the data that have been made available up to this time. These data may be divided into two groups (1) the laboratory investigations, and (2) the theoretical analyses.

Laboratory Investigations

The two fields of research carried on in the various laboratory investigations are: (1) physiological aspects of radiant heating; and (2) heat transfer. The physiological aspects have not been considered until quite recently, but already there are enough data to define the limits of human comfort (1,2)[1], to set up a *comfort equation* (3,4), and to select maximum allowable panel surface temperatures. Additional physiological data are necessary and the required research is in progress.

The second field of laboratory investigations, that on heat transfer, is further advanced. Almost complete data are available for heat transfer from the panel surface out to the occupant, but data on heat transfer from the panel surface into the pipe coils is still incomplete. Data on internal heat transfer for two specific panels have been prepared and partly incorporated in the tables in this Reference Section. Data on internal heat transfer are published in the literature (5,6) and are being gathered in the ASHVE laboratory in Cleveland, Ohio.

Theoretical Analyses

The second group of data available at the present time has been developed by pure theoretical analyses based on research data. Probably the most complete mathematical analysis was prepared by Professor F. W. Hutchinson (4,7,9) of the University of California. His analysis reduces radiant heating to pure mathematical form so that real engineering design is possible. In the course of his work he established two new equations: (1) the comfort equation; and (2) the equivalent conductance equation. The use of the comfort equation permits the designer to "build-in" the desired comfort conditions in his initial analysis. The equation states that the sum of the mean radiant temperature and ambient air temperature is a constant for a given level of comfort conditions. The comfort constant is designated a in this discussion. The second equation—for equivalent conductance—simplified the radiation effects so that all structures can be compared and classified in a single equation.

To these two equations, Professor Hutchinson added another equation (for ventilation loads) and set up a

[1]Numbers in parentheses refer to the Bibliography except where enumeration is obvious by context.

design procedure (7). The disadvantage of his procedure was that it did not offer an opportunity to consider the mean panel water temperature. In order to include the water temperature in the analysis, a fourth equation—a panel equation—was needed. The panel equation and its addition to the Hutchinson equations is treated in the Appendix.

The four equations and their solutions set up a design procedure slightly different from the Hutchinson procedure. They represent a distillation of the thinking of the past 10 years. They provide a straightforward, rational design procedure based on laboratory investigations and theoretical analyses. To facilitate their use, thousands of solutions have been set up in tabular form. Four tables, sufficient for design at 0F outside and residential comfort conditions ($a = 140$) using floor, wall, or ceiling panels, and for commercial conditions ($a = 120$) using floor panels, are shown in this discussion and are applied to a specific design problem. There are 36 such tables, covering a wide range of design conditions in the National Tube Co. design book mentioned at the head of this article. Designers can calculate solutions for any design conditions using equations offered in the appendix to this section.

The remaining sections of this article will be discussions of a design procedure for radiant heating. In this procedure, there are two phases (1) the layout and (2) the detail. The design layout consists of the broad decisions and assumptions such as the design constants to be used, the panel placement, and the layout of the equipment. The detailed design is actually the numerical computation required to size the panels and the equipment.

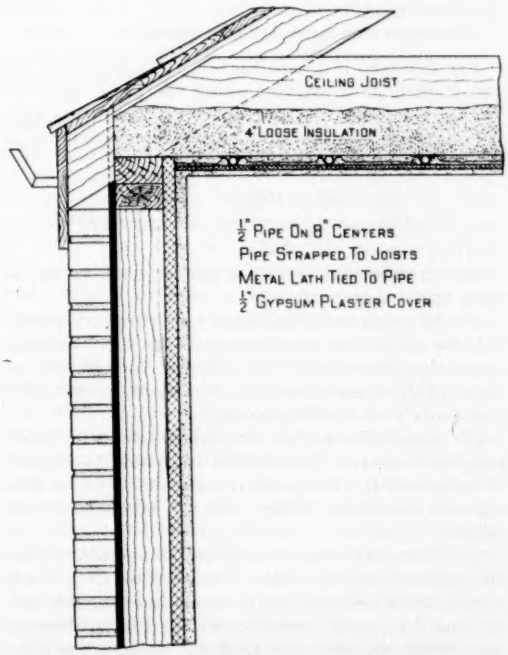


Fig. 1. Ceiling panel construction detail.

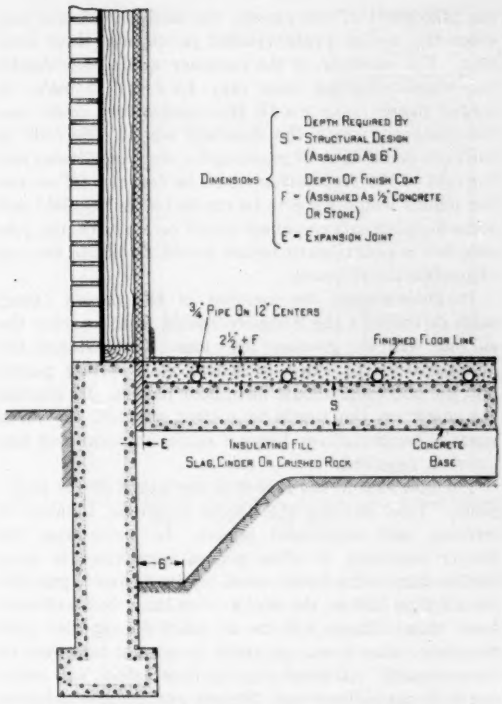


Fig. 2. Floor panel construction detail.

An example is given to illustrate the design procedure and to help the reader use the graphs and tables contained in this article.

Design Layout

The first step in the layout is the selection of the design constants. Before sizing the heating equipment, the designer must first determine the required optimum comfort conditions. For residence, school, or office designs, it is customary to use a comfort constant a, of 140F (see Glossary in the Appendix). For commercial structures, it is customary to let $a = 120$F. The comfort constant a is one term that determines which of the design tables is to be used. The selection of a fixes the comfort conditions to be produced by the system.

The other coefficients to be selected are those for heat transfer. These coefficients appear as h_p, h_c and R in the equations in the Appendix. They are, respectively, convection coefficient from panel to air, convection coefficient from air to unheated walls, and thermal resistance from pipe to panel surface. If the designer will use the panel construction shown in Fig. 1 or Fig. 2, these heat transfer coefficients will be properly evaluated for the equations used in the design tables. If the panel construction is to be changed, then R will be changed and the solutions must be worked out. The values for R used here have been determined by research in the National Tube Co. laboratories.

The second step in the layout is the consideration of

the placement of the panels; the designer should consider the use of prefabricated panels and their location. For example, if the designer would consistently use standard panel sizes (say 4 x 8 ft) to make up larger panels (say 8 x 16 ft), contractors could prefabricate and stock the standard sizes. The bulk of the coils could then be made under shop conditions and the cost of the installation would be reduced. Of course, the panels would have to be connected in the field and some supplementary panels would be made on the jobsite, but a preliminary layout would facilitate the use of prefabricated panels.

In determining the location of the panels (floor, wall, or ceiling) the designer should first consider the surface with the greatest heat loss. For instance, the bedrooms in the example should have ceiling panels and the playroom should have floor panels. By placing the panel on the would-be coldest surface, the room surface temperatures become more uniform and less panel is required.

The last step in the layout is the layout of the boiler room. This includes the header locations, number of circuits, and equipment layout. In estimating the header locations, it often proves convenient to keep the headers in the boiler room. This makes it possible for all pipe laid in the floors or ceilings to be of uniform size. There will be no need for special pipe trenches, valve boxes, or vents in several locations in the structure. All large pipe, balance valves, and vents can be in the boiler room. This is particularly valuable when filling the system; the waste water can spill on to the floor and be carried off through the floor drain, and the separate lines can be bled for long periods to remove all the air.

For panels not adjacent to the boiler room, the supply and return lines will serve as panel areas for other rooms. If the lines are long enough (maybe 50 to 60 ft), it will be necessary to consider the water temperature drop in the line from the boiler to the panel. This means, of course, that the panel water temperature will be fixed by the conditions of the design; therefore, the designer should start his design with an assumption of the panel water temperature.

The design tables, included in this article on page 79, are set up specifically for starting the design with panel water temperature. Most other design procedures start with panel surface temperatures, or panel areas, but this is rarely convenient in an engineering analysis. With the procedure given here, panel area and output are subordinated to panel water temperature.

Detailed Design

The detailed design is the longer phase and consists of four parts: (1) the classification of each room; (2) the determination of the panel area; (3) the determination of the panel output; and (4) the sizing of the equipment (pumps, boiler, etc.).

The term classification is used because the thermal characteristics *classify* the room; U_e (equivalent transmittance) classifies the transmittance and V_c (ventilation constant) classifies the ventilation. By determining U_e and V_c, and selecting the design outside air temperature, the designer can get the panel area and panel output (steps 2 and 3) from the design tables. It should be noted here that the determination of U_e requires the assumption of an approximate panel area. Subsequent computation using either the design tables on page 79 or the quartic equation developed in the Appendix will establish the true panel area. If the assumed area differs from the true area by more than 20%, a new assumption should be made. A guide to assumed panel areas is given in Table 1, in connection with an example calculation, which follows this discussion.

The simplest explanation of the determination of U_e and V_c is given in the example. Definitions of U_e and V_c are given in the Appendix, but a thorough treatment is best given in reference 4 listed in the Bibliography.

In cases where a panel in an adjacent room is backed by a surface on the problem room, there is the consideration of back losses. For instance, in designing bedroom floor panels in the example in this article. The designer should consider the back-losses from the ceiling panel as *gains* in the floor above. A more detailed explanation on the treatment of back losses is given in the Appendix.

Steps 2, 3, and 4 of the detailed design are explained in the example. Additional considerations are listed as follows:

(1) In estimating the water temperature for a given room use the equation

$$t = t_1 - \frac{Q}{500G}$$

where

t_1 = inlet water temperature, F
G = flow, gpm
Q = heat loss from fluid, Btu per hr.

For example, if a pipe carrying 5.0 gpm must run 100 ft through a corridor where the panel output is 50 Btu per (hr) (ft) (of pipe) and the water temperature was initially 120F, then the temperature at the end of the corridor would be

$$t = 120 - \frac{50 \times 100}{500 \times 5} = 120 - 2 = 118\text{F}$$

The temperature, 118F, would be used as the t_w term in the design tables.

(2) In rooms requiring small supplementary panels, run the supply and return lines in the floor if ceiling panels are used and in the ceiling if floor panels are used. This is especially true if a structure will have cold floors with a ceiling panel.

(3) Keep panel surface temperature down for physiological reasons. This subject is treated thoroughly in reference 1. Temperatures are indicated by plus signs in the design tables, and are explained in the legend.

(4) There are many ways of installing radiant panels, especially in floor slabs. Two sketches (Fig. 1 and Fig. 2) have been included to illustrate acceptable ceiling and floor panel installations. In Fig. 2, showing floor detail, no insulation is shown beneath the pipe. There are times, however, when strip or sheet insula-

tion is economically advisable, but before insulation is recommended, a comparison of fuel savings against initial cost must be made.

For a floor panel, it is important to have a solid slab of concrete under the coil so that ground water cannot seep up and around the pipe. This sub-slab is the structural slab, but if economically possible, it should be made of insulating concrete. Such construction reduces the time lag of the panel and also reduces the fuel cost.

The gist of one article (8) on control for radiant heating is ".... that an inside air thermostat is adequate to control certain [most] radiant heating installations where the panel .... responds [to change in load] at least as readily as the occupants." Of course, where zoning is necessary, more complex control systems are necessary. Also, in contracts for thousands of dollars, elaborate control equipment can be justified. The point of the above quotation, however, is that the variation in the inside air temperature is not so great as to require modulation of heat input (8,9). On the other hand, it is not considered good practice to suddenly start and stop the fluid flow in the coils. Such control will probably cause the control equipment to "hunt" because of the sudden influx of cooler or warmer water. In other words, in any control system continuous fluid flow is superior to on-off fluid control. The best control system, of course, is to use 3-way modulating valves that mix return and supply water.

Boiler water temperature is then controlled by an outside air temperature controller. For small structures (homes, stores, shops, etc.), an on-off inside air thermostat controlling the boiler operation, a continuously operating pump, and high limit control on the boiler water temperature is adequate for all but exceptional cases. The exceptional cases are those with 4 inches or more concrete (3 or more air changes). In the exceptional cases, competent control engineers should be consulted.

Example

An example is given to illustrate the design procedure as previously described. The structure selected for the example was designed specifically for this article. Although the structure is shown as a residence in Fig. 3, it is intended to be a structure that presents a difficult design. Every design problem is met in this structure so that this one example will illustrate every point of a radiant heating design. As a result, the house is not particularly suitable for living conditions but is an excellent illustration of the flexibility and ease of radiant panel heating design.

In following the design procedure described above, the first step is to select the proper coefficients. The coefficients (noted as comfort constants, a) were selected as 120F for the rooms where the occupants would be quite active, and as 140F for the normal living rooms of the house. The heat transfer coefficients have been based on the assumption that the panel construction will be like Fig. 1 and 2. The same construction has been used in selecting the coefficients used in the equations for the design tables.

In the placing of the panels for the kitchen, dining room, and living room, it was necessary to consider

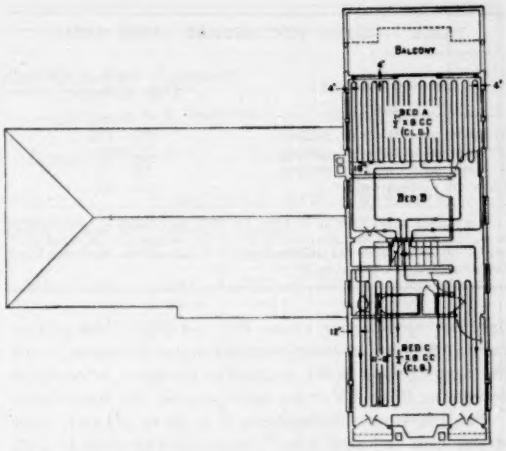


Fig. 3. Second floor plan. First floor has floor panel in hobby room and ceiling panels in kitchen, dining, and living rooms directly under bedrooms.

the heat losses from the bedroom and playroom. This deviation from the rule of placing panels in the surface with the greatest heat loss, is permissible here because both floor and ceiling are adjacent to heated areas, and wall panels are impractical. Panel placement, therefore, was decided by considering the heat losses of the room *behind* the panel. Since the second floor rooms would be more difficult to heat than the basement rooms, it was decided to use ceiling panels on the first floor and use the *back losses* as floor panel booster effects in the second floor rooms.

The layout of the equipment (in the laundry) was restricted because of the corner location of the chimney. The large wall on the stairway was appropriated for the headers so that all headers would be accessible and in one location. All pipe leaving the headers will be either ½-inch (for the ceiling coils) or ¾-inch (for the floor coils). Such a location for the risers (on the stair wall) provide heat for the stairwell. By heating the stairwell, chimney effects and drafts are reduced.

The detailed design may be traced by following the design form, shown in Fig. 4. As a guide to detailed design, the panel for Bedroom C will be discussed.

First, the room is sized and the total area is computed. The panel is placed in the ceiling because that would be the surface with the greatest heat loss if no panel were there. Since the room is some distance from the boiler, where water is at 120F, a temperature drop was calculated for the supply lines (using the equation given previously under *Detailed Design*). The mean panel water temperature was found to be 113F. The initial assumption of panel area for calculation of U_e was that the panel would be 125 sq ft, in accordance with Table 1. The resulting actual area was not in good agreement with the first assumption, so a second assumption of $A_p = 110$ sq ft was made (shown on the design form, Fig. 4.)

A bedroom should be kept at living room conditions, so the comfort constant was selected as 140F. Being a ceiling panel, $R = 0.74$. (The R term is not actually

TABLE 1—GUIDE FOR ASSUMED PANEL AREAS.

Exposed Surfaces	Percent of Floor or Ceiling That Is Panel
3 walls plus floor or ceiling	90 - 100
2 walls plus floor or ceiling	75 - 90
1 wall plus floor or ceiling	50 - 75
Floor or ceiling only	45 - 60

If assumed panel area is in error by 20% as compared to computed area, the error will not appreciably affect the design. If the error is in excess of 20%, then the calculation for U_e should be repeated using the first result as an estimate.

used by the designer unless R is *not* 0.74; then adjustments in panel area and output must be made.) All the assumptions being made, the designer is ready to determine U_e and V_c (see the Appendix for equations).

The glass area in Bedroom C is 52 sq ft, and, since storm sash are used, the U value for the glass is 0.45. Windows are exposed to the outside air so $\triangle t_r = 1.0$.

$$U_{ng} = \frac{52 \times 0.45 \times 1.0}{870} = 0.027.$$

(Note: A_t (total area) $- A_p$ (panel area) $= 980 - 110 = 870$ sq ft; the unheated surface area in the room.)

Where $\triangle t_r$ is a function of the temperature difference between outside air and ventilation air and is equal to 1.0 in all cases except where ventilation air is preheated; U_{ng} is a measure of the effect of glass transmission on the over-all room equivalent transmittance, U_e.

The U_n values for the exposed walls and the unheated portion of the ceiling are found. Since the floor is the back of the living room panel, the "back losses" from the living room will warm the floor of the bedroom. These "back losses" amount to 2,750 Btu per hr and serve to reduce the U_e value. The effect of the "back losses" is $\frac{2,750}{870 \times 70} = 0.045$ Btu per (hr) (sq ft) (F). This term is subtracted from the sum of the U_n terms $0.027 + 0.000 + 0.043 + 0.024 - 0.045 = 0.049$, so we assume that $U_e = 0.05$.

The ventilation effect, V_c, has been computed by the crack method (using half the window crack in this room) but could be estimated by the air-change method. Total ventilation used here was 990 cfh, or about ½ air-change per hour. This gives $V_c = 990/980 = 1$.

With the completion of the room classification (determination of U_e and V_c) the designer is now ready to determine panel area and output. The proper design table for this panel is the $t_o = 0$F, ceiling panel, a = 140F, table on page 79. With $V_c = 1$, go down to the group of values in the $V_c = 1$ box. In that box select the $U_e = 0.05$ line and go to the $t_w = 110$F and $t_w = 115$F. Interpolating for $t_w = 113$F (used for Bedroom C) gives $u = 0.118$ and $q = 30.3$. Then $A_p = uA_t - 0.118 \times 980 = 115$ sq ft. With the construction shown in Fig. 1, the panel efficiency is 90%, so the boiler load imposed by the Bedroom C panel is 3,860 Btu per hr.

The last step in the design is the sizing of the equipment. The boiler is sized by adding the boiler loads shown on the design form, Fig. 4, to get 57,236 Btu per hr. There should be an overload allowance to provide recovery after night set-back and also overload to provide for sub-design temperatures. Generally, it is sufficient to use the next larger boiler or about 20%—this would be a boiler size of 69 Mbh.

The hydraulic calculations are listed in Table 2. The equivalent and actual pipe lengths for each coil are determined by using Fig. 5 and the friction loss in the pipe line is determined by using Fig. 6 (see column for head loss in Table 2).

Specifications

The following specifications are typical for a radiant heating system:

(1) *Boiler:* The heating boiler shall be automatic gas or oil fired, having an output of 69,000 Btu per hr. This boiler shall be complete with standard safety devices, including a high limit control set to keep water below 180F.

(2) *Circulating Pumps:* Circulating pumps of an approved make shall be furnished and installed for (1) the floor and (2) ceiling circuits. The pumps must operate smoothly and quietly without vibration, and flexible connections shall be used if it is necessary to prevent transmission of sound.

The pump motors shall be designed to operate on 110 volt, 60 cycle, single phase current. Both pumps shall be capable of fulfilling the following requirements:

Twelve gpm against a head of 12 ft of water pressure, using ¼-hp, 1800-rpm, direct-connected motor.

The pumps shall be so installed that they may supply the entire system in event of failure in either motor.

(3) *Expansion Tank:* Furnish and install where shown on the plans one 18-gallon expansion tank of welded steel construction and certified to withstand a static air pressure of 100 psi for a period of two hours without drop.

(4) *Radiant Heating Panels:* Panels shall be of the size and arrangement shown on the plans. Any section of piping showing evidence of flattening or splitting shall not be repaired but shall be removed from the panel. No threaded joints will be permitted in concealed mains, branches or panels. Spacing will be as shown on the plans for each panel.

TABLE 2—HYDRAULIC CALCULATIONS.

Panel	Zone	Equivalent Length, L_e, Ft	Flow, GPM*	Head Loss, Feet
Kitchen No. 1	First	201	1.0	2.8
Kitchen No. 2	First	206	1.0	2.9
Living No. 1	First	149	1.2	2.8
Living No. 2	First	178	1.2	3.4
Bed A No. 1	Second	193	0.7	1.4
Bed A No. 2	Second	197	0.7	1.4
Bed C No. 1	Second	138	1.0	1.9
Bed C No. 2	Second	152	1.0	2.1
Hobby	Third	250	1.9	2.8
Play	Third	280	2.3	4.2

*Flow is based on a water temperature drop of 10F in the panel.

RADIANT PANEL HEATING DESIGN FORM

STRUCTURE Residence LOCATION Somewhere DESIGNER H. V. Engineer DATE Now

WIND VELOCITY 15 MPH WIND DIRECTION North OUTSIDE AIR TEMP. 0 F GROUND TEMP. +50 F FOR BASEMENT

BASEMENT AIR TEMP. + 60 F (APPROX.) ATTIC TEMP. ——— ROOMS PARTIALLY HEATED NO PANELS IN STORAGE ROOMS

	PURPOSE	KITCHEN	DINING	LIVING	1ST LAV.	BED A	BED B	BED C	LAUNDRY	PLAY	HOBBY
ROOMS	SIZE	$11^{2}\times16^{2}\times8^{2}$	$16^{2}\times12^{2}\times8^{2}$	$16^{2}\times21^{2}\times8^{2}$	$4^{2}\times8^{2}\times8^{2}$	$12^{2}\times16^{2}\times7^{2}$	$12^{2}\times7^{2}\times7^{2}$	$16^{2}\times15^{2}\times7^{2}$	$10^{2}\times21^{2}\times7^{2}$	$15^{1/2}\times26^{2}\times7^{2}$	$19^{2}\times12^{2}\times7^{2}$
	TOTAL AREA	784	832	1264	272	824	488	980	896	1219	738
	PANEL LOCATION	CEILING	CEILING	CEILING	FLOOR	CEILING	CEILING	CEILING	FLOOR	FLOOR	FLOOR
ASSUMPTIONS	AVE. WATER TEMP.	115	110	115	100	113	108	113	100	100	100
	ASSUMED AREA U	0.224 H76°	0.110 H92°	0.218 H75°	0.129 H35°	0.231 H90°	0.037 H8°	0.112 H10°	0.089 H80°	0.226 H75°	0.224 H69°
	UNHEATED AREA	608	740	989	237	634	470	870	816	944	573
	COMFORT CONSTANT a	140	140	140	140	140	140	140	120	120	120
	RESISTANCE R	0.74	0.74	0.74	0.46	0.74	0.74	0.74	0.46	0.46	0.46
GLASS	NET AREA A_g	42	32	128	5	52	13	52	10	21	40
	ASHVE CODE	STORM SASH AND ALL WINDOW AREA EXCEPT IN BASEMENT							SINGLE SASH		STORM SASH
	U_g	0.45	0.45	0.45	0.45	0.45	0.45	0.45	1.13	1.13	0.45
	Δt_{rg}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	U_{ng}	0.031	0.019	0.058	0.009	0.037	0.013	0.027	0.014	0.025	0.031
DOORS	NET AREA A_d	19	—	—	—	97	—	—	—	—	40
	ASHVE CODE	1½" STORM DOOR	—	—	—	GLASS STORM DOOR	—	—	—	—	FIRE DOOR
	U_d	0.35	—	—	—	0.45	—	—	—	—	1.13
	Δt_{rd}	1.0	—	—	—	1.0	—	—	—	—	0.5
	U_{nd}	0.011	0.000	0.000	0.000	0.069	0.000	0.000	0.000	0.000	0.048
EXPOSED WALLS	NET AREA A_w	210	64	304	31	150	43	308	27 38 147	164 218	170 56
	ASHVE CODE	32 D	32 D	32 D	32 D	8 D	8 D	8 D	WEST WEST WEST	ABOVE 7.5 A / BELOW 2 A	32 D 67 A
	U_w	0.13	0.13	0.13	0.13	0.12	0.12	0.12	79 A 77 A 2 A	0.70 0.67	0.13 0.50
	Δt_{rw}	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.70 0.70 0.67 / 1.0 0.33 0.15	1.0 0.33	1.0 0.50
	U_{nw}	0.045	.011+.010×.004	0.040	0.017	0.028	0.011+.008 = 0.003	0.043	0.053	0.163	0.063
CEILING	NET AREA A_c	ALL	NO EXPOSED	36	8	76		142	DINING	LIVING	180
	ASHVE CODE	PANEL	CEILING	45 F	45 F	45 F		45 F	BACK LOSS	BACK LOSS	45 F
	U_c	AREA	SURFACE	0.15	0.15	0.15		0.15	Q = 2400	Q = 3530	0.15
	Δt_{rc}			1.0	1.0	1.0		1.0	$A_g t_o$ = 43960	$A_g t_o$ = 26640	1.0
	U_{nc}		0.000	0.000	0.023	0.002		0.024	−0.049	−0.042	0.047
FLOOR	NET AREA A_f	150 HEAT	192	336	PANEL	DINING AND KITCHEN	DINING	LIVING	200*	85	15
	ASHVE CODE	IN TO	IN	IN	AREA	BACK LOSS	BACK LOSS	BACK LOSS	TABLE 13	TABLE 13	TABLE 13
	U_f	0.34 STORAGE	0.34	0.34	—	Q = 2150	Q = 1020	Q = 2750	0.10	0.10	0.10
	Δt_{rf}	0.29 AREA	0.14	0.14	—	$A_g t_o$ = 84380	$A_g t_o$ = 32900	$A_g t_o$ = 51000	0.29	0.29	0.29
	U_{nf}	0.024	0.012	0.016	0.000	−0.048	−0.031	−0.065	0.007	0.002	0.001
U_s	ΣU_n	0.11	0.03	0.11	0.05	0.09	0.01	0.05	0.025	0.15	0.18
VENTILATION	RATE CFH/FT. CRACK	50	33	33	33	60	33	33	33	33	33
	CRACK LENGTH	19	25	67	10	31	15	30	15	13	22
	TOTAL CFH	950	825	2211	330	1860	495	990	495	430	726
	Δt_r	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	V_c	1.0	1.0	2.0	1.0	2.0	1.0	1.0	0.3	0.2	1.0
RESULTS	u	0.223	0.109	0.223	0.130	0.232	0.020	0.118	NO PANEL IS REQUIRED BECAUSE LOSSES FROM SUPPLY AND RETURN LINES ARE ENOUGH.	0.236	0.217
	PANEL AREA A_p	BED A 87 / BALC. 53	91	282	35	191	16	115		287	180
	OUTPUT q	32.8 / 32.8	27.8	32.8	31.7	31.1	5.0	30.3		35.3	46.2
	ADJUSTED u	— / —	—	—	—	—	—	—		—	—
	ADJUSTED q	— / —	—	—	—	—	—	—		—	—
	EFFICIENCY e	BED A 0.75 / BALC. 0.90	0.75	0.75	0.90	0.90	0.90	0.90		0.90	0.90
	BOILER LOAD	3818 3210	3380	12330	1230	6600	90	3860	3200	11250	8230

ALL AREAS IN SQUARE FEET

$\Delta t_r = \frac{t_a - t_p}{t_a - t_o}$ SEE GLOSSARY

* 60 SQ. FT. OF PANEL COMES FROM WALL AT THE HEADER STATION.

ASHVE CODE REFERS TO TYPE OF CONSTRUCTION AS LISTED IN ASHVE GUIDE

$U_{ng} = \frac{A_g \Delta t_{rg} U_g}{A_g}$

BOILER LOAD = $\frac{A_p q}{e}$ B/HR

Fig. 4. Radiant heating design form.

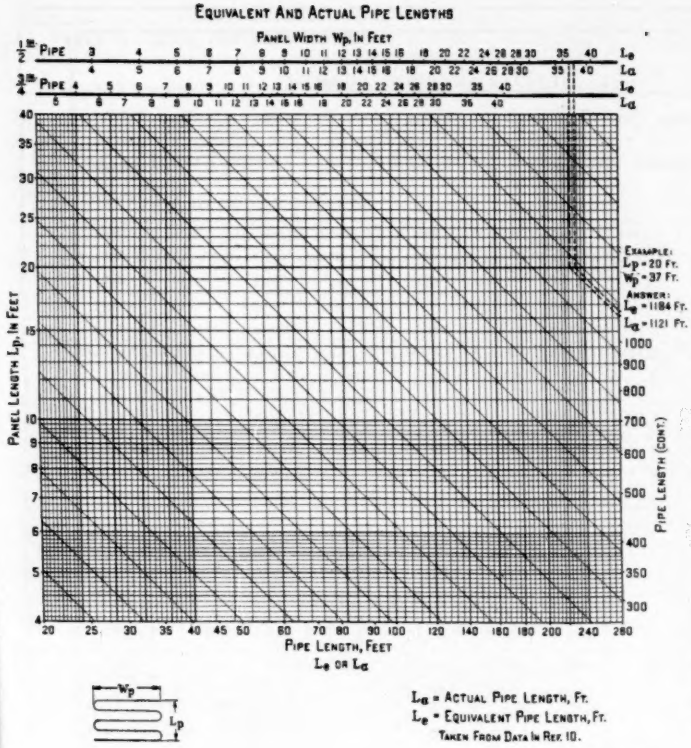


Fig. 5. Chart for determining actual and equivalent length of ½-inch pipe on 8-inch centers, or ¾-inch pipe on 12-inch centers in sinuous pipe coils.

Floor Panels: A concrete sub-floor will be constructed by others at the desired grade as specified by the heating contractor. The panel will be secured to this floor in such a manner that the piping will not shift when covered with concrete. The piping will be covered by the concrete to a depth at the thinnest point of approximately 1½ inches to the top of the pipe, as shown in Fig. 2.

Ceiling Panels: Before the erection of the metal lath, the piping will be securely fastened to the joists. The lath will then be fastened to the pipe and the ceiling plastered. It is the responsibility of the heating contractor to see that plaster is forced through the lath to completely cover the back part of the pipe. (See Fig. 1 for illustration).

Panels will be constructed as follows:

Location	*Pipe Size, Inches*	*Material (See Piping)*
Floors	¾	Steel Pipe
Walls	½	Steel Pipe
Ceiling	½	Steel Pipe

(5) *Piping:* All radiant heating piping shall be scale-free, black, butt-welded, steel pipe (ASTM A-120).

(6) *Three-Way Mixing Valves:* Furnish installed, to control zones for second and first floor ceiling, and basement floor, three, three-way mixing valves. Valves are to be made with bronze body and trim. Seats shall be of the removable, screwed insert type. They shall be of ½-inch size, 2-psi pressure diff., 60-sec motor timing, 125-psi static pressure, and screwed body pattern.

(7) *Controls:* An outdoor compensating temperature controller of the remote bulb type will maintain a pre-

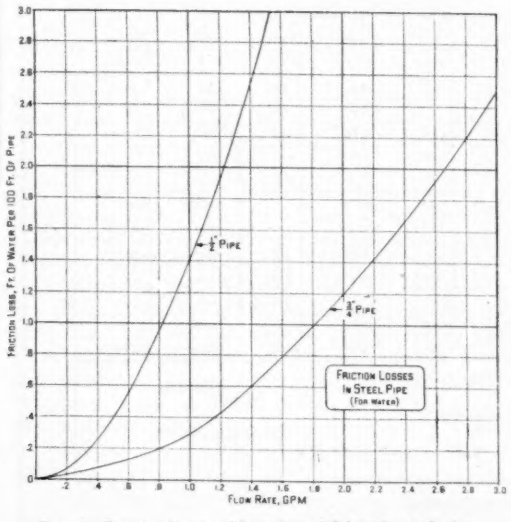


Fig. 6. Friction loss in ½-inch and ¾-inch steel pipe.

LEGEND FOR DESIGN TABLES

(See opposite page)

Notation	Panel Surface Temperatures		
	Ceiling Panels	Wall Panels	Floor Panels
Plain	Up to 100F	Up to 95F	Up to 80F
One plus mark	100—110F	95—105F	80—85F
Two plus marks	Above 110F	Above 105F	Above 85F

All ceiling and wall panels are ½-inch steel pipe on 8-inch centers with ½-inch gypsum plaster covering and approximately 10% back loss (see appendix).

All floor panels are ¾-inch steel pipe on 12-inch centers with 2-inch concrete cover and approximately 10% back loss (see appendix).

Panel surface temperatures are classed so that (1) regular type indicates ideal temperatures; (2) one plus mark indicates maximum permissible temperatures; and (3) two plus marks indicate temperatures that must be used advisedly. The physiological effects of panel surface temperatures are treated fully in reference 1.

Design Tables

(See legend opposite page)

t_o = 0F — Floor Panel — a = 140

V_c	t_w / U_o		90	95	100	105	110	115	120	125	130
0	0.05	u	.136	.113+	.096+	.084++	.075++	.067++	.061++	.056++	.052++
		q	22.9	28.3+	33.7+	39.1++	44.5++	49.9++	55.3++	60.7++	66.1++
	0.10	u	.231	.196+	.171+	.152++	.136++	.123++	.113++	.104++	.096++
		q	21.8	29.2+	36.6+	40.0++	43.4++	50.8++	58.2++	61.6++	67.0++
	0.15	u	.300	.260+	.230+	.205++	.186++	.170++	.156++	.144++	.134++
		q	24.5	29.9+	35.3+	40.7++	46.1++	51.5++	56.9++	62.3++	67.7++
	0.20	u	.365	.322+	.287+	.259++	.236++	.217++	.201++	.187++	.175++
		q	25.6	30.6+	36.0+	41.4++	46.8++	52.2++	57.6++	63.0++	68.4++
	0.25	u	—	.364+	.328+	.298++	.274++	.253++	.235++	.219++	.206++
		q	—	31.2+	36.6+	42.0++	47.4++	52.8++	58.2++	63.6++	69.0++
1	0.05	u	.178	.149+	.128+	.113++	.100++	.090++	.082++	.076++	.070++
		q	23.0	28.4+	33.8+	39.2++	44.6++	50.0++	55.4++	60.8++	66.2++
	0.10	u	.257	.220+	.192+	.171++	.154++	.140++	.128++	.118++	.110++
		q	23.9	29.3+	34.7+	40.1++	45.5++	50.9++	56.3++	61.7++	67.1++
	0.15	u	.334	.281+	.250+	.232++	.211++	.193++	.178++	.165++	.154++
		q	24.6	30.0+	35.4+	40.8++	46.2++	51.6++	57.0++	62.4++	67.8++
	0.20	u	.385	.341+	.305+	.277++	.253++	.233++	.216++	.201++	.188++
		q	25.3	30.7+	36.1+	41.5++	46.9++	52.3++	57.7++	63.1++	68.5++
	0.25	u	—	.390+	.353+	.322++	.296++	.274++	.255++	.239++	.224++
		q	—	31.3+	36.7+	42.1++	47.5++	52.9++	58.3++	63.7++	69.1++
3	0.05	u	.249	.212+	.185+	.163++	.147++	.133++	.122++	.112++	.104++
		q	23.2	28.6+	34.0+	39.4++	44.8++	50.2++	55.6++	61.0++	66.4++
	0.10	u	.325	.282+	.250+	.224++	.203++	.185++	.171++	.158++	.147++
		q	24.1	29.5+	34.9+	40.3++	45.7++	51.1++	56.5++	61.9++	67.3++
	0.15	u	.397	.351+	.315+	.285++	.261++	.240++	.223++	.208++	.194++
		q	24.8	30.2+	35.6+	41.0++	46.4++	51.8++	57.2++	62.6++	68.0++
	0.20	u	—	.384+	.347+	.316++	.290++	.268++	.249++	.233++	.219++
		q	—	30.9+	36.3+	41.7++	47.1++	52.5++	57.9++	63.3++	68.7++
	0.25	u	—	—	.392+	.360++	.333++	.310++	.289++	.271++	.256++
		q	—	—	36.9+	42.3++	47.7++	53.1++	58.5++	63.9++	69.3++
7	0.05	u	—	.334+	.297+	.267++	.243++	.223++	.206++	.191++	.178++
		q	—	29.0+	34.4+	39.8++	45.2++	50.6++	56.0++	61.4++	66.8++
	0.10	u	—	—	.344+	.313++	.287++	.264++	.246++	.229++	.215++
		q	—	—	35.3+	40.7++	46.1++	51.5++	56.9++	62.3++	67.7++
	0.15	u	—	—	—	.355++	.327++	.303++	.283++	.265++	.249++
		q	—	—	—	41.4++	46.8++	52.2++	57.6++	63.0++	68.4++
	0.20	u	—	—	—	—	.356++	.332++	.311++	.292++	.276++
		q	—	—	—	—	47.5++	52.9++	58.3++	63.7++	69.1++
	0.25	u	—	—	—	—	—	.369++	.347++	.327++	.310++
		q	—	—	—	—	—	53.5++	58.9++	64.3++	69.7++

t_o = 0F — Ceiling Panel — a = 140

V_c	t_w / U_o		100	110	115	120	125	130	135	140	145
0	0.05	u	.146	.113	.102	.092	.084	.078	.072+	.067+	.063+
		q	20.8	28.0	31.6	35.2	38.8	42.4	46.0+	49.6+	53.2+
	0.10	u	.245	.196	.178	.163	.151	.140	.130+	.122+	.115+
		q	21.7	28.9	32.5	36.1	39.7	43.3	46.9+	50.5+	54.1+
	0.15	u	.330	.262	.241	.222	.207	.193	.181+	.170+	.161+
		q	22.4	29.6	33.2	36.8	40.4	44.0	47.6+	51.2+	54.8+
	0.20	u	.384	.322	.298	.277	.259	.243	.229	.216+	.205+
		q	22.9	30.1	33.7	37.3	40.9	44.5	48.1	51.7+	55.3+
	0.25	u	—	.380	.353	.331	.311	.293	.277	2.63-	.250+
		q	—	30.3	33.9	37.5	41.1	44.7	48.3	51.9+	55.5+
1	0.05	u	.185	.144	.130	.118	.108	.100	.093+	.087+	.082+
		q	20.9	28.1	31.7	35.3	38.9	42.5	46.1+	49.7+	53.3+
	0.10	u	.285	.232	.212	.195	.181	.169	.158+	.148+	.140+
		q	21.8	29.0	32.6	36.2	39.8	43.4	47.0+	50.6+	54.2+
	0.15	u	.351	.291	.268	.248	.231	.217	.204+	.192+	.182+
		q	22.5	29.7	33.3	36.9	40.5	44.1	47.7+	51.3+	54.9+
	0.20	u	—	.352	.326	.305	.286	.269	.254	.240+	.228+
		q	—	30.2	33.8	37.4	41.0	44.6	48.2	51.8+	55.4+
	0.25	u	—	.402	.375	.352	.331	.313	.297	.282+	.269+
		q	—	30.4	34.0	37.6	41.2	44.8	48.4	52.0+	55.6+
3	0.05	u	.267	.214	.194	.178	.164	.153	.142+	.134+	.126+
		q	21.1	28.3	31.9	35.5	39.1	42.7	46.3+	49.9+	53.5+
	0.10	u	.346	.285	.262	.242	.225	.210	.198+	.186+	.176+
		q	22.0	29.2	32.8	36.4	40.0	43.6	47.2+	50.8+	54.4+
	0.15	u	—	.347	.321	.300	.280	.264	.249+	.236+	.224+
		q	—	29.9	33.5	37.1	40.7	44.3	47.9+	51.5+	55.1+
	0.20	u	—	.397	.370	.347	.327	.309	.292	.278+	.264+
		q	—	30.4	34.0	37.6	41.2	44.8	48.4	52.0+	55.6+
	0.25	u	—	—	—	.386	.365	.346	.329	.313+	.299+
		q	—	—	—	37.8	41.4	45.0	48.6	52.2+	55.8+
7	0.05	u	.399	.332	.307	.285	.266	.249	.234+	.221+	.210+
		q	21.5	28.7	32.3	35.9	39.5	43.1	46.7+	50.3+	53.9+
	0.10	u	—	.376	.350	.327	.306	.289	.273+	.258+	.246+
		q	—	29.6	33.2	36.8	40.4	44.0	47.6+	51.2+	54.8+
	0.15	u	—	—	.401	.377	.356	.337	.320	.305+	.291+
		q	—	—	33.9	37.5	41.1	44.7	48.3	51.9+	55.5+
	0.20	u	—	—	—	—	.394	.374	.356	.340+	.326+
		q	—	—	—	—	41.6	45.2	48.8	52.4+	56.0+
	0.25	u	—	—	—	—	—	—	.397	.380+	.364+
		q	—	—	—	—	—	—	49.0	52.6+	56.2+

t_o = 0F — Wall Panel — a = 140

V_c	t_w / U_o		100	105	110	115	120	125	130	135	145
0	0.05	u	.130	.113	.100	.090	.082	.075	.069+	.064+	.056+
		q	23.1	27.0	30.9	34.8	38.7	42.6	46.5+	50.4+	58.2+
	0.10	u	.225	.200	.180	.163	.150	.138	.128+	.120+	.106+
		q	24.1	28.0	31.9	35.8	39.7	43.6	47.5+	51.4+	59.2+
	0.15	u	.301	.271	.247	.227	.209	.195	.182	.171+	.152+
		q	25.0	28.9	32.8	36.7	40.6	44.5	48.4	52.3+	60.1+
	0.20	u	.360	.329	.302	.279	.260	.243	.228	.215+	.192+
		q	25.7	29.6	33.5	37.4	41.3	45.2	49.1	53.0+	60.8+
	0.25	u	—	.386	.357	.332	.311	.292	.276	.261	.235+
		q	—	30.1	34.0	37.9	41.8	45.7	49.6	53.5	61.3+
1	0.05	u	.172	.151	.135	.122	.111	.102	.094+	.087+	.076+
		q	23.2	27.1	31.0	34.9	38.8	42.7	46.6+	50.5+	58.3+
	0.10	u	.268	.239	.215	.196	.180	.166	.155+	.144+	.128+
		q	24.3	28.2	32.1	36.0	39.8	43.8	47.7+	51.6+	59.4+
	0.15	u	.332	.301	.275	.254	.235	.219	.205	.193+	.172+
		q	25.1	29.0	32.9	36.8	40.7	44.6	48.5	52.4+	60.2+
	0.20	u	.392	.359	.332	.308	.287	.269	.253	.239+	.215+
		q	25.8	29.7	33.6	37.5	41.4	45.3	49.2	53.1+	60.9+
	0.25	u	—	.394	.370	.345	.323	.304	.287	.272	.246+
		q	—	30.2	34.1	38.0	41.9	45.8	49.7	53.6	61.4+
3	0.05	u	.255	.227	.204	.186	.170	.157	.146+	.136+	.120+
		q	23.4	27.3	31.2	35.1	39.0	42.9	46.8+	50.7+	58.5+
	0.10	u	.322	.291	.265	.243	.225	.209	.196+	.184+	.163+
		q	24.4	28.3	32.2	36.1	40.0	43.9	47.8+	51.7+	59.5+
	0.15	u	—	.360	.331	.307	.286	.268	.252	.238+	.213+
		q	—	29.2	33.1	37.0	40.9	44.8	48.7	52.6+	60.4+
	0.20	u	—	—	.372	.347	.325	.305	.288	.273+	.247+
		q	—	—	33.8	37.7	41.6	45.5	49.4	53.3+	61.1+
	0.25	u	—	—	—	.359	.367	.346	.328	.312	.284+
		q	—	—	—	38.2	42.1	46.0	49.9	53.8	61.6+
7	0.05	u	—	.337	.308	.284	.263	.245	.230+	.216+	.193+
		q	—	27.7	31.6	35.5	39.4	43.3	47.2+	51.1+	58.9+
	0.10	u	—	—	.354	.328	.306	.287	.270	.255+	.230+
		q	—	—	32.6	36.5	40.4	44.3	48.2	52.1+	59.9+
	0.15	u	—	—	.383	.358	.335	.315	.298	.282+	.255+
		q	—	—	33.5	37.4	41.3	45.2	49.1	53.0+	60.8+
	0.20	u	—	—	—	—	.361	.370	.352	.335	.305+
		q	—	—	—	—	42.0	45.9	49.8	53.7	61.5+
	0.25	u	—	—	—	—	—	—	.383	.366	.335+
		q	—	—	—	—	—	—	50.3	54.2	62.0+

t_o = 0F — Floor Panel — a = 120

V_c	t_w / U_o		95	100	105	110	115	120	125	130	140
0	0.25	u	.272	.247	.227+	.210+	.195++	.182++	.171++	.161++	.144++
		q	41.6	47.2	52.8+	58.4+	64.0++	69.6++	75.2++	80.8++	92.0++
	0.30	u	.307	.281	.260+	.241+	.225++	.211++	.198++	.187++	.168++
		q	42.3	47.9	53.5+	59.1+	64.7++	70.3++	75.9++	81.5++	92.7++
	0.35	u	.343	.314	.291+	.271+	.254++	.239++	.225++	.213++	.192++
		q	42.9	48.5	54.1+	59.7+	65.3++	70.9++	76.5++	82.1++	93.3++
	0.40	u	.370	.342	.318+	.298+	.279++	.263++	.248++	.235++	.214++
		q	43.4	49.0	54.6+	60.2+	65.8++	71.4++	77.0++	82.6++	93.8++
	0.45	u	.395	.366	.342+	.320+	.301++	.285++	.270++	.255++	.233++
		q	43.8	49.4	55.0+	60.6+	66.2++	71.8++	77.4++	83.0++	94.2++
1	0.25	u	.291	.265	.244+	.226+	.210++	.197++	.185++	.174++	.156++
		q	41.7	47.3	52.9+	58.5+	64.1++	69.7++	75.3++	80.9++	92.1++
	0.30	u	.329	.297	.274+	.255+	.238++	.223++	.210++	.199++	.179++
		q	42.4	48.0	53.6+	59.2+	64.8++	70.4++	76.0++	81.6++	92.8++
	0.35	u	.353	.326	.302+	.282+	.264++	.248++	.234++	.222++	.201++
		q	43.0	48.6	54.2+	59.8+	65.4++	71.0++	76.6++	82.2++	93.4++
	0.40	u	.384	.356	.332+	.311+	.292++	.275++	.261++	.247++	.224++
		q	43.5	49.1	54.7+	60.3+	65.9++	71.5++	77.1++	82.7++	93.9++
	0.45	u	.414	.385	.360+	.338+	.319++	.302++	.286++	.272++	.248++
		q	43.9	49.5	55.1+	60.7+	66.3++	71.9++	77.5++	83.1++	94.3++
3	0.25	u	.320	.293	.270+	.251+	.234++	.220++	.207++	.195++	.176++
		q	41.9	47.5	53.1+	58.7+	64.3++	69.9++	75.5++	81.1++	92.3++
	0.30	u	.352	.324	.301+	.280+	.262++	.247++	.233++	.220++	.199++
		q	42.6	48.2	53.8+	59.4+	65.0++	70.6++	76.2++	81.8++	93.0++
	0.35	u	.385	.357	.332+	.311+	.292++	.275++	.260++	.247++	.224++
		q	43.2	48.8	54.4+	60.0+	65.6++	71.2++	76.8++	82.4++	93.6++
	0.40	u	.410	.381	.356+	.334+	.315++	.298++	.282++	.268++	.244++
		q	43.7	49.3	54.9+	60.5+	66.1++	71.7++	77.3++	82.9++	94.1++
	0.45	u	.438	.409	.383+	.361+	.341+	.323++	.307++	.292++	.267++
		q	44.1	49.7	55.3+	60.9+	66.5+	72.1++	77.7++	83.3++	94.5++
7	0.25	u	.375	.345	.321+	.299+	.281++	.266++	.250++	.236++	.214++
		q	42.3	47.9	53.5+	59.1+	64.7++	70.3++	75.9++	81.5++	92.7++
	0.30	u	.408	.378	.353+	.331+	.311++	.294++	.279++	.265++	.240++
		q	43.0	48.6	54.2+	59.8+	65.4++	71.0++	76.6++	82.2++	93.4++
	0.35	u	.432	.402	.377+	.354+	.334++	.316++	.300++	.286++	.260++
		q	43.6	49.2	54.8+	60.4+	66.0++	71.6++	77.2++	82.8++	94.0++
	0.40	u	.459	.430	.404+	.381+	.360+	.342++	.325++	.310++	.284++
		q	44.1	49.7	55.3+	60.9+	66.5+	72.1++	77.7++	83.3++	94.5++
	0.45	u	.480	.451	.425+	.402+	.381+	.362++	.345++	.330++	.302++
		q	44.5	50.1	55.7+	61.3+	66.9+	72.5++	78.1++	83.7++	94.9++

determined water temperature in the boiler, depending on the outside air temperature. This controller must be able to vary the water temperature from 65F to 130F when the outside temperature changes from 65F to 0F. The controller shall be provided with a manually operated device which, for unusual temperature conditions, will permit the system to be operated at a water temperature either above or below that which is considered normal for the existing outdoor temperature. This device shall have an effect on the water temperature of + or — 15% of the operating range of the water temperature controller.

When the outside temperature is below 65F, the controller or auxiliary switch will keep the pumps in continuous operation.

Three room thermostats shall be located as follows: (1) Playroom; (2) Living room; (3) Bedroom C. These thermostats are of the modulating type and shall operate three-way mixing valves. These valves shall mix return water and boiler water according to the thermostat setting. These thermostats shall have ranges from 58F to 82F with a differential of 3F. They shall be set for 60F in the playroom and 70F in the living room and bedroom.

An "emergency" (on-off) switch shall be provided which will cut off all electrically operated equipment.

(8) *Pressure Reducing and Relief Valve:* The water supply to the boiler shall be equipped with a ¾-inch pressure reducing and relief valve. The drain from the relief valve shall discharge to the floor drain in the laundry. The relief valve shall open at a pressure of 30 psi.

(9) *Air Vents:* Air vents shall be of the manual type (petcocks) and shall be installed at the high point in the return line. The vents shall discharge through a ¼-inch tube to the floor drain in the laundry.

(10) *Balancing Fittings:* Furnish and install in the return line from each panel a square-head cock for balancing the flow. These fittings shall be designed for 125 psi water pressure and be of the size of the respective pipes.

(11) *Pressure Tests:* Before connecting to the equipment and concealing in floor, walls, or ceiling, all heating piping shall be subjected to a hydrostatic test of 65 psi (or line pressure), for two hours.

After the completion of the entire heating system, it shall be placed in operation by the contractor and tested under 30 psi operating pressure in the presence of the engineer. The duration of the test shall be at least six hours. Fuel shall be furnished by the owner.

(12) *Adjustment and Trial Run:* The system shall be filled in such a manner as to vent the air from the system without leaving any air pockets. The system shall not be run at normal operating temperatures until the plaster and concrete are thoroughly dried out. The system shall not be started until the engineer has given his approval to start the initial operation. The system shall be balanced by the adjustment of the square-head cocks.

Conclusion

The work of many investigators has been culled to develop this straightforward, rational design procedure. Its four advantages are: (1) the system is thermally balanced in the design; (2) comfort conditions are considered in the analysis; (3) physiological limits are readily determined; and (4) it is based upon laboratory and theoretical analysis.

Of the four advantages only the first—thermal balance—is unique with this system. But it is this thermal balance characteristic that is an important omission in other systems. It is rarely possible for a designer to control each panel independently, and yet this is necessary if the system is to have *designed thermal balance*. As can be seen from the example, the panels are designed according to the water temperature that will be in the panel. Yet this balance can be obtained from an inside air thermostat because when the comfort conditions are desirable, the water temperature will be as predicted (or determined) in the design. In other words, the balance lies in the design equations which are solved and tabulated for the designer.

GLOSSARY

Temperature Terms

t_a = inside air temperature F, generally assumed as a/2
t_p = panel temperature, F
t_e = equivalent temperature of unheated surface areas, F
t_o = outside air temperature, F
t_w = mean water temperature in coils, F
t_s = temperature of air entering room or the temperature of the air in adjacent room, F

Heat Transfer Coefficients

h_c = convection film coefficient, air to unheated areas, Btu per (hr) (sq ft) (F) (see Appendix for values)
h_p = convection film coefficient, panel to air, Btu per (hr) (sq ft) (F) (see Appendix for values)
h_r = radiation coefficient, panel to non-panel areas, Btu per (hr) (sq ft) (F) (see Appendix for values)
C_e = equivalent conductance from non-panel area to outside, Btu per (hr) (sq ft) (F)
U_e = equivalent transmittance from inside air to outside air, Btu per (hr) (sq ft) (F)
R = thermal resistance, pipe to panel surface, (F) (sq ft) (hr) per Btu

Area Terms

A_t = total surface area of room, sq ft
A_p = surface area of panel, sq ft
A_e = vA_t sq ft
$u = A_p/A_t$
$v = 1 - u$, dimensionless

General Terms

q = panel output, Btu per (hr) (sq ft)
a = comfort constant, F
V = ventilation rate of air at t_o, cfh

$\Delta t' = t_a - t_s$, F
$\Delta t = t_a - t_o$, F
$\Delta t_r = t_a - t_r$, F
$\Delta t_e = t_a - t_e$, F
Δt_w, etc.

$$V_e = \frac{V\Delta t'}{A_t \Delta t} \text{ cu ft per (hr) (sq ft)}$$

$$\Delta t_r = \frac{\Delta t'}{\Delta t} = 1.0$$ in all cases except where ventilation air is preheated.

Δt_{ef} as shown in the kitchen on the design form, Fig. 4, is

$$\Delta t_{ef} = \frac{70 - t_s}{70 - t_o}$$

t_o = 0F, design temperature

t_s = 50F, air temperature in the storage rooms

so

$$\Delta t_{ef} = \frac{70 - 50}{70 - 0} = 0.29$$

Subscripts

a = inside air
c = ceiling
e = equivalent
f = floor
g = glass
i = surface not losing heat
o = outside air
p = panel
t = total
w = exposed walls

APPENDIX

Derivation of Equations

The theory used in developing the tables of this article has been discussed in the literature (3), and has been named the "Theory of Equivalent Conductance." It has been shown that the results obtained from using this theory are well within the limits of engineering accuracy[4].

When applying the theory of equivalent conductance to determine panel loads, the actual room is replaced by an equivalent room where all surfaces (except the panel) are assumed to be made of a uniform and homogeneous material. All surfaces, consequently, have equal conductance; this single conductance is called *equivalent* conductance.

A similar term is *equivalent transmittance*. Equivalent conductance and equivalent transmittance are related by the equation.

$$U_e = \frac{U_g A_g \Delta t_g + U_f A_f \Delta t_f + U_c A_c \Delta t_c + U_w A_w \Delta t_w + U_i A_i \Delta t_i}{(A_g + A_f + A_c + A_w + A_i)\ (t_a - t_o)}$$

(See Glossary for definition of the terms)

and

$$C_e = \frac{f_i U_e}{f_i - U_e}$$

Where

f_i = inside film coefficient, Btu per (hr) (sq ft) (F)

All of the energy required to maintain comfort conditions in an enclosure may be accounted for in three basic heat balances; the energy released by the water in the coil to the enclosure may be accounted for in a fourth balance.

For the first heat balance we will take the comfort equation which can be considered as a heat balance on the occupant.

$$t_a + ut_p + vt_c = a \qquad (1)$$

[Two values of a are given in the Design Tables and are based on the data in reference 12.]

The second heat balance is that on the non-panel area A_c, and is derived as follows:

Energy transmitted to outside air = $A_c C_c (t_c - t_o)$

Energy convected to non-panel areas from air = $A_c h_c (t_a - t_c)$

Energy radiated to non-panel areas by the panel = $A_p h_r (t_p - t_c)$ (shape factor = 1 since all non-panel areas are at temperature t_c)

Energy received = energy transferred (for equilibrium conditions)

so

$$A_c C_c (t_c - t_o) = A_c h_c (t_a - t_c) + A_p h_r (t_p - t_c)$$

divide by A_t and re-arrange

$$h_c v t_a + h_r u t_p - [v(C_c + h_c) + h_r u]\ t_c = -C_c v t_o \qquad (2)$$

The third heat balance is that on the ventilation air, and is derived as follows:

Energy convected from panel area = $A_p h_p (t_p - t_a)$

Energy convected to non-panel areas = $A_c h_c (t_a - t_c)$

Energy required to warm ventilation air = $V w c_p (t_a - t_o)$

let wc_p = 0.018 Btu per (cu ft) (F)

Energy received = Energy transferred (for equilibrium conditions)

so

$$A_p h_p (t_p - t_a) = A_c h_c (t_a - t_c) + 0.018\ V (t_a - t_o)$$

Divide by A_t

then

$$h_p u (t_p - t_a) = h_c v (t_a - t_c) + 0.018 V_c (t_a - t_o)$$

regroup to get

$$(h_c v + 0.018\ V_c + h_p u)\ t_a - h_p u t_p - h_c v t_c = 0.018\ V_c t_o \qquad (3)$$

The fourth heat balance is that on the panel itself and is derived as follows:

Energy radiated from unit panel area = $h_r (t_p - t_c)$

Energy convected from unit panel area = $h_p (t_p - t_a)$

$$\text{Energy conducted from coils to surface} = \frac{t_w - t_p}{R}$$

Equating gives

$$h_r (t_c - t_c) + h_p (t_p - t_a) = \frac{t_w - t_p}{R}$$

regroup to get

$$Rh_p t_a - [R(h_r + h_p) + 1]\ t_p + Rh_r t_c = -t_w \qquad (4)$$

The value of R has been determined experimently and values for R are listed below.

Equations (1), (2), (3), and (4) are simultaneous and their solution can be written as the quartic equation.

$$u^4 + \alpha u^3 + \beta u^2 + \gamma u + \delta = 0$$

(where the coefficients are functions of t_w, etc.)

This equation can be solved to give values of u. Equations (1), (2), and (3) can then be solved to obtain values for t_p, t_a, and t_c, (see reference[2] for full treatment (by the equations given below).

Heat emission from the panel surface is given as

$q = h_r (t_c - t_c) + h_p (t_p - t_a)$, Btu per (hr) (sq ft)

where

$$h_r = \frac{\sigma (T_p^4 - T_c^4)}{t_p - t_c}$$

σ = Stefan-Boltzman constant

T = absolute temperature, degrees Rankine.

From the conditions of the problem.

U_c, V_c, a, t_o, t_w, location of the panel, and thermal resistance of the panel are known. From the data in the tables, u and v can be determined. To determine other temperatures, use the following equations:

$$t_p = t_w - Rq \qquad (5)$$

$$t_a = \frac{uq}{(1 - u)\ U_c + 0.018 V_c} + t_o \qquad (6)$$

$$t_c = \frac{a - t_a - ut_p}{1 - u} \qquad (7)$$

Values for h_c and h_p in equations 2, 3 and 4 are:

Location	h_c	h_p
Ceiling Panel	0.8	0.4
Wall Panel	0.7	0.7
Floor Panel	0.8	1.1

Values for R:

¾-inch pipe on 12-inch centers (construction as in Fig. 2)
R = 0.46

½-inch pipe on 8-inch centers (construction as in Fig. 1)
R = 0.74

Determining the Advantageous Effect of Back Losses to Adjacent Rooms: When radiant panels have back losses absorbed by adjacent rooms, the advantageous effect can be calculated by including the back loss in the calculation of

U_e for the next room. For example, assume that a second floor room with a full ceiling is receiving q_b Btu per (hr) (sq ft) from the ceiling panel in the room below. The U_e of the second floor room is calculated as follows:

$$U_e = \frac{U_w A_w (t_a - t_c) + U_g A_g (t_a - t_c) - q_b A_{pf} + U_1 A_1 (t_a - t_o)}{A_e (t_a - t_o)}$$

Where A_{pf} is the amount of floor area that is receiving the back losses from the ceiling below. Notice that the units of the back losses do not permit the inclusion of $(t_a - t_o)$ so the Δt term must appear in the denominator to keep the units consistent.

Determining Back Loss from A Panel: Back loss from a panel is defined as the amount of heat that flows from the pipe to the surface opposite the surface used in warming the room. For example, back loss from a floor panel is the heat that is transferred from the water through the pipe to the ground or basement; back loss from a ceiling panel is the heat transferred from the water through the pipe to the attic.

It is sufficiently accurate to assume that the pipe forms a plane parallel to the back face passing through the center of the pipe. The thermal resistance from the pipe to a surface, then, is

$$R_b = \frac{1}{1.65} + \frac{x_1}{k_1} + \ldots\ldots\ldots + \frac{x_n}{k_n}$$

$$\text{Back loss, } q_b = \frac{t_w - t_b}{R_b}$$

where t_b = temperature of back surface, F.

R_b = thermal resistance to back panel, (F) (hr) (sq ft) per Btu

Another form of the above equation would be:

$$q_b = \frac{qR + t_p - t_b}{R_b}$$

which is derived from Equation (5).

The value of t_w can be obtained from the tables in this article and the values of t_b can generally be approximated from the following equations:

$$q_b = 1.65\ (t_b - t_{a1}) \qquad (8)$$

where 1.65 = combined radiation and convection coefficient of heat transfer, Btu per (hr) (sq ft) (F)

t_{a1} = air temperature of the adjacent unheated space, F or

$$q_b = h_r\ (t_b - t_a) + h_c\ (t_b - t_a) \qquad (9)$$

[Equation (9) to be used when adjacent room is heated]. As an example, using Equation (8)

$$t_b = \frac{q_b}{1.65} + t_{a1} \quad \text{so}$$

$$q_b = \frac{1.65\ t_w - (q_b + 1.65\ t_{a1})}{1.65\ R_b}$$

or

$$q_b = \frac{t_w - t_{a1}}{R_b + 0.606} \qquad (10)$$

The term efficiency is

$$e = \frac{q}{q + q_b}$$

Some values of e are:

Ceiling Panels	
1. Uninsulated	e = 50%
2. Insulated with 3 inches rock wool or equivalent	e = 90%
Wall Panels	
1. On concrete block or hollow tile	e = 50%
2. Frame wall, uninsulated	e = 50%
3. Frame wall, insulated	e = 90%
Floor Panels	e = 50 to 90%

The efficiency of floor panels varies with the length of time the system has been in operation. Thus early fall the floor slab efficiency may be low as 50% and the same panel in mid-winter (design conditions) may have an efficiency of 90%. The caution to be exercised is in the thermal capacity of the floor slab. Insulation under a floor slab will increase the sensitivity to response, and it is this feature that is of prime importance in floor slabs.

Supplementary Panels

Very often the floor panels or ceiling panels alone are not sufficient to maintain optimum comfort. In such cases, it is necessary to use supplementary panels. One suggestion is to use the supply and return lines as supplementary panels. For example, in a structure using ceiling panels the supply and return lines can be run through the floor and up the walls to the ceiling. These lines then make up considerable supplementary panel area.

As an example, assume that we have a structure with $U_e = 0.20$, $V_c = 3$ and that $t_o = 0$F. We are using a ceiling panel and $t_w = 120$F, and a = 140F. The table given for ceiling panel gives u = 0.347 and q = 37.6. If the room is 10 x 20 with 10-ft ceiling, then the ceiling is only 200 sq ft and the required panel area is 0.347 x 1000 = 347 sq ft. It is necessary to have a supplementary panel that is equivalent to 147 sq ft of ceiling panel. Lets assume that all of the extra panel is to be in the wall. Looking at the table for wall panels and the same U_e, V_c, t_w, etc., we see that q = 41.6 so the wall panel must be $\frac{37.6}{41.6} \times 147$ or about 133 sq ft. U_e should be recalculated using 133 sq ft of wall area as panel area.

Often it is not necessary to recalculate U_e because the effect of the supplementary panel area on U_e is too slight to be of significance.

References

(1) Herrington, L. P., and Lorenzi, R. J., Effect of Panel Location on Skin and Clothing Surface Temperature, *Heating, Piping and Air Conditioning*, October, 1949.

(2) DuBois, E. F., The Mechanism of Heat Loss and Temperature Regulation, *Lane Medical Lectures*, 1937.

(3) Chapman, W. P., and Fischer, R. E., Graphical Solution of a Direct Equation for Radiant Panel Areas, *Heating and Ventilating*, January, 1948.

(4) Hutchinson, F. W., and Raber, B. F., *Panel Heating and Cooling Analysis*, John Wiley and Sons, New York, 1947.

(5) Hulbert, L. E., Nottage, H. B., and Franks, C. V., Heat Flow Analysis in Panel Heating or Cooling Sections, *Heating, Piping and Air Conditioning*, April, 1950.

(6) Humphreys, C. M., Nottage, H. B., Franks, C. V., Huebscher, R. G., Schutrum, L. F., and Locklin, D. W., Laboratory Studies on Heat Flow Within a Concrete Panel. *Heating, Piping and Air Conditioning*, April, 1950.

(7) Hutchinson, F. W., A Single-Equation Design Procedure for Radiant Panel Systems, *ASHVE Transactions*, vol. 52.

(8) Chapman, W. P., and Fischer, R. E., Simplifying Comfort Control for Radiant Heating, *Heating and Ventilating*, June, 1948.

(9) Hutchinson, F. W., Response and Lag in the Control of Panel Heating Systems, *Heating, Piping and Air Conditioning*, February, 1947.

(10) Foxhall, W. B., Friction Loss in Sinuous Pipe Coils, *Heating and Ventilating*, December, 1949.

(11) Mathewson, J. S., Behavior of Radiant Heated Hardwood Floors, *Heating and Ventilating*, September, 1950.

(12) Strock, C., *Heating and Ventilating Engineering Databook*, Industrial Press, 1948.

Highlights of ASRE Convention

An account of the main events at the American Society of Refrigerating Engineers convention held in New York City, and brief abstracts of many of the papers that were presented at the technical sessions.

THE three men principally responsible for the development of the Freon family of refrigerants were presented with awards at the annual convention of the American Society of Refrigerating Engineers that was held at the Hotel Commodore, New York City, December 3 to 6. Over 800 members and guests registered for the four technical sessions and social events.

The awards were presented at the dinner-dance by Dr. C. F. Kettering, vice president and research consultant of General Motors Corp., who instigated the research that led to the discovery of Freon-12. A Certificate of Recognition was presented to Dr. Albert L. Henne, Robert R. McNary, and posthumously to Thomas Midgley.

At the Welcome Luncheon, the speaker was Vilhjalmur Stefansson, Arctic explorer and lecturer, who since 1947 has been compiling a 20-volume Encyclopedia Arctica. He spoke on Natural Cold Storage.

Inspection trips were made to the United Nations Secretariat Building (H & V Dec. 1949, p 57), and to the new refrigeration installation (H & V, Jan. 1950, p 65) in the Consolidated Edison Co. headquarters in New York City. Special social features were provided for the ladies.

The Wolverine Award was presented to W. L. Holladay, Hieatt Engineering Co., Los Angeles, Calif., for his paper on Low Temperature Test Chamber Design. The Best Section Paper award was presented to W. B. Doddard, district engineer, Carrier Corp., Chicago, Ill., for his paper on Freon-12 Refrigerant Pipe Sizes.

A committee has been named to revise the constitution of the society and to have its report ready for the spring meeting that will be held May 27 to 30 at the Hotel Statler, Detroit, Mich. The winter meeting is to be held at New Orleans, La., December 2 to 5. Atlanta, Ga., has been selected as the host city for the 1952 spring meeting.

The newly elected officers of the ASRE are: President, Paul B. Christensen, vice president and chief engineer, Merchants Refrigerating Co.; vice presidents, Edward Simons, consulting engineer, San Francisco, Calif., and Richard C. Jordan, professor of mechanical engineering and acting head of department, University of Minnesota; treasurer, Donald K. Tressler, consultant, Westport, Conn. Members of council include C. M. Ashley, chief development engineer, Carrier Corp.; Leon Buehler, Jr., chief refrigerating engineer, Creamery Package Manufacturing Co.; Oliver C. Eckel, Boston branch manager, Mundet Cork Corp.; Milton Kalischer, manager, electric appliance engineering department, Springfield, Mass.; Daniel C. McCoy, manager of commercial section, Frigidaire Division, General Motors Corp.; J. R. Hornaday, chief engineer, Norge Division, Borg-Warner Corp.

The convention program included special sessions devoted to the heat pump, room air conditioners and domestic refrigerators. Abstracts of some of the papers presented follow:

Absorption Air Conditioner

E. P. Whitlow and L. A. McNeely, development engineers, Servel, Inc., presented a paper on the Absorption Air Conditioner which covered the steps in designing a 20-ton system.

In the air conditioning field, Servel has been producing 3-ton and 5-ton absorption units. Carrier has developed an absorption unit available in sizes from 115 to 200 tons. Between these two groups there was a vacant space, and it was for this zone that the 20-ton unit was developed. These 20-ton steam operated units can be installed in multiple.

The unit was developed to operate on low pressure steam. At the rated capacity, the steam consumption is 18.1 lb per ton-hr. However, there is some variation from this figure, depending upon the performance factor as determined by the temperature of the condensing water available. The chilled water flow at the rated condition was 3.5 gpm per ton, but this flow can be varied markedly without any adverse effects on the capacity. At the rated condition, the condensing water rate is about 3 gpm per ton. The nominal capacity is based on the unit supplying chilled water at 45F with condensing water entering at 85F and leaving at 105F.

Air Conditioning Old Buildings

Walter L. Fleisher, consulting engineer, New York City, discussed Air Conditioning Old Buildings. Use of air conditioning in buildings was restricted because of the control of strategic material. When reconversion started in 1946, the air conditioning of large existing buildings again became a problem of vital importance.

If the engineer believes he has problems with air conditioning systems for new buildings where he has free reign, how much more complex is the conditioning of old buildings in which equipment is already installed. For general economy, a central air conditioning system, at least in part, must be employed for air conditioning existing large buildings. A careful examination must be made to determine if the structure will support a cooling tower.

Mr. Fleisher touched on some of the existing designs and engineering economics. He injected into his paper the results of many years' experience.

Reflective Radiation

Dr. Clarence A. Mills, professor of experimental medicine, University of Cincinnati, in his paper on Residential Cooling by Reflective Radiation, described his house at Reflection Point in Cincinnati. All ceilings and sidewalls of this house, with the exception of the lower 4 ft in the bathroom, are covered with tinted and embossed foil wall coverings. A heat transparent

Photo courtesy Irving Alter

Bottom row, left to right: newly elected officers of the ASRE. Treasurer, Donald K. Tressler; vice president, Edward Simons; president, Paul B. Christensen; vice president, Richard C. Jordan. Upper row, council members, Leon Buehler, Jr., C. M. Ashley, Oliver C. Eckel, J. R. Hornaday, Daniel C. McCoy and Milton Kalischer.

tinted lacquer was then applied. Electrical heating elements are placed in a cove near the room ceiling. Below this, in a trough is a copper tube carrying Freon, connected with a ¾ hp compressor in the basement. A two-speed fan was installed to build up a positive air pressure. Dr. Mills claims that he has achieved indoor comfort with this system at roughly one-third of the calculated heating or cooling loads of conventional air conditioning.

Heat Pump Progress

Recent Progress in Electric Heat Pump Development was covered by W. F. Friend, mechanical engineer, Ebasco Services, Inc.

While there has been a lull in heat pump publicity during 1950, many manufacturers and utilities are planning for active sales promotion and production programs to start before the 1951 summer cooling season.

Recent activities and the present trend in electric heating-cooling applications may be summarized as follows:

(1) Wider recognition of the principle that the heat pump must ultimately be considered as an all-year air conditioner, with emphasis on the summer cooling service it provides.

(2) As a corollary to (1), one should recognize that the geographical areas in which the heat pump should first achieve general acceptance are in the south and the southwest, where cooling is fully as important as heating.

(3) It must be acknowledged that for several years ahead, the heat pump may still constitute for residences a semi-luxury type of plant, and probably will continue to find its main market in commercial places.

(4) There is a shift of emphasis from ground coils as a heat source toward outdoor air. However, well water continues to predominate in localities where adequate ground water is found near the surface with winter temperature above 50F and free from objectionable substances in solution.

(5) With air as a heat source, it is necessary to have some method of storing heat during short intervals, when extreme outdoor temperatures occur.

(6) Continuation of research is necessary to find methods for increasing the rate of heat transfer from earth to buried coils, and of conserving the ground temperature.

(7) There should be an investigation of possibilities in the use of solar radiation as a supplement to outdoor air or to ground coils for heat supply.

All-Year, All-Weather Conditioning

S. J. Levine, Air Conditioning Department, General Electric Co., described the company's all-year all-weather air conditioning. He said that General Electric Co. has been active in this field for the past 18 years but that during the spring and summer of 1949, eight nominal 6 hp air-to-air heat pumps were installed. These packaged units have two 3 hp motors to drive the two 3-ton reciprocating compressors. Each installation was provided with an instrument panel, and by means of a camera, the panel was photographed on 16 mm film every time the electric circuit of the heat pump was energized. These data were tabulated on IBM cards. About 70 million pieces of information are available.

This year a number of single 3 hp units were installed to obtain comfort information. It is the intent of G E to continue operation of these field test units through the present heating and cooling seasons.

Unloading Compressor Installation

Another paper in the conference was one on Report on the Use of an Unloading Compressor in a Heat Pump Installation, by R. A. Gonzalez, Airtemp Division, Chrysler Corp., Dayton, Ohio.

Two pilot installations were made in Philadelphia in the fall of 1948 and this was made possible by the Philadelphia Electric Co. These installations use a glycol solution to transfer heat through ground coils. Following tests conducted in the winter of 1948-49, changes and improvements were made to both systems. One had its capacity increased to 9½ hp—the other remained at its initial 5 hp.

The author considers that it is within the realm of possibility that the modulating system can be improved to show a definite advantage over intermittent operation of heat pump cycles.

Marvair Units

M. M. Smith, vice president, Muncie Gear Works, Muncie, Ind., in his paper, Living With a Thousand Marvairs, said that Marvair units were now operating

in 38 states. About 1,000 Marvairs have been in operation in homes, office buildings, theaters, hotels, hospitals and factories. At first, recording instruments were put on all units but this was stopped because this practice seemed to give customers the impression that the unit was still in the experimental stage.

The coldest climate in which this unit has been operating is Oregon where the heat pump has been in service for 3 years. With incoming water at 48F, the coefficient of performance was 3.2. In Florida and Texas, water temperatures are better than 70F. Units are not on the heating cycle for more than 3 months and the coefficient of performance is better than 4 to 1.

Muncie Gear Works has been working closely with electric power utilities all over the country. Fifteen of the largest utility companies are now cooperating in promoting the use of these units in the home.

Heat Pump Water Heater

A paper on The Heat Pump Water Heater, by A. W. Ruff, V. C. Patterson & Associates, Inc., York, Pa., presented practical information on heat pump design and field test results.

Findings indicate that the heat pump water heater is a practical appliance for the home. Domestic water can be heated to 145F economically. Water usage has varied from 30 to 110 gallons per day with the average at 60 gallons per day.

Dehumidification produced by heat pump units in year-round operation has proved advantageous and under some conditions as much as one gallon of moisture was collected in 24 hours. The cooling effect produced was found practical in homes. Mr. Ruff said that users reported dry bulb temperature reductions up to 10F. The consumed kwh was about one-third that used on a comparable resistance heating unit.

Tests proved the need for higher coefficients of performance and the new models that are now under test are expected to show better results.

Heat Pump Research and Development

A picture of recent and current research and development projects in the heat pump field in the United States was presented by Charles H. Coogan, Jr., professor and head of mechanical engineering, The University of Connecticut, in his paper on A Survey of Heat Pump Research and Development Projects.

The author, based on questionnaires that were mailed out to companies, organizations, colleges and utilities engaged in heat pump research, prepared extensive tables that list the project, name of director, object, status, and completion date.

Heat Transfer Coefficients

W. L. Bryan and G. W. Quaint, respectively assistant professor of heat power engineering, and instructor in mechanical engineering, Case Institute of Technology, presented information on Heat Transfer Coefficients in Horizontal Tube Evaporators. Data was presented to show the pressure drop and heat transfer rates which occur when Freon-11 evaporates inside a smooth horizontal tube with and without a turbulence promoter installed. A correlation of heat transfer vs pressure drop is presented from these data as well as for previously published data for Freon-12 and water.

Dynamic Characteristics of a Solid Adsorbent

The performance of a solid desiccant exposed to a dynamic air stream is affected by a large number of variables. Equipment was developed to determine the effects of certain variables independently and this was described in a paper on Dynamic Characteristics of a Solid Adsorbent, by W. L. Ross, instructor, mechanical engineering department, and E. R. McLaughlin, associate professor of engineering research, The Pennsylvania State College, State College, Pa. Summaries are given of the various tests conducted by the authors. Results are presented in graphical form to permit interpolation and to show trends.

When the dynamic characteristics of the adsorbent are known, the problems which arise with new applications, it is claimed, can be simplified appreciably. Industrial gases, refrigerants and petroleum materials are some of the many products that are improved by the use of adsorbents.

Adsorption Type Desiccants

W. A. Pennington, chemist, Carrier Corp., Syracuse, N. Y., summarized the result of studies of adsorption desiccants in his paper on The Role of Adsorption Type Desiccants Within Refrigeration Units. Equilibrium studies were made with refrigeration units involving the moisture content of Freon-12 and the adsorption desiccants, silica gel and Sovabead.

Both of these desiccants were found to have equal capacity for moisture adsorption in Freon-12 and that they could be dehydrated to absolute bone dryness by vacuum at an elevated temperature.

A drier containing the desiccants tested, where placed at the beginning of the evaporator, is more than twice as effective as one in the suction line, Freon-12 being the refrigerant. This same drier is about 6 times as effective as one on the high side, if the drier temperature is as much as 130F.

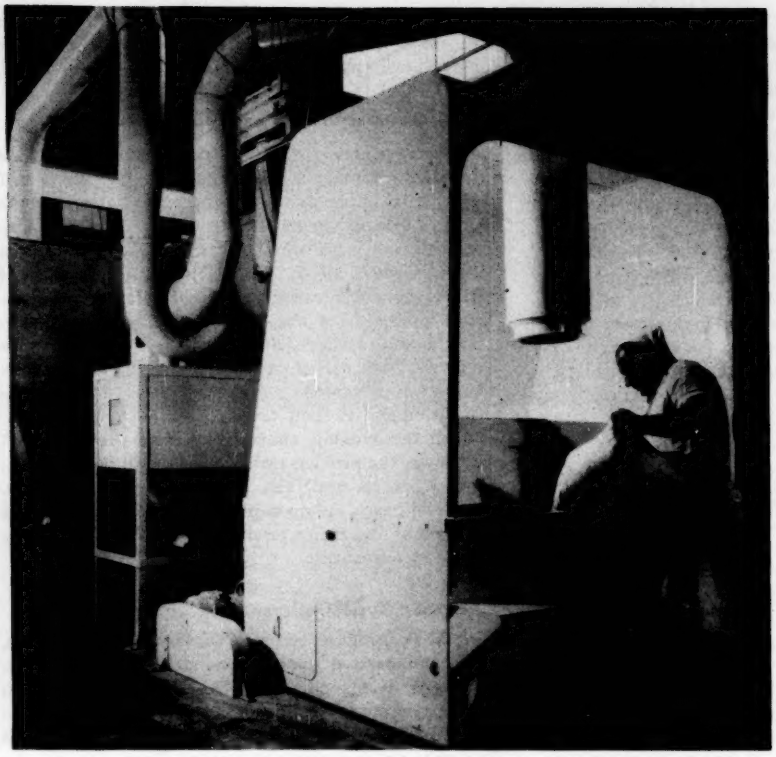
The author presented a means for predicting the capacity of driers in various positions.

Quality Control

One of the three papers presented during the conference on room air conditioners was Quality Control in the Manufacture of Room Air Conditioners, by F. E. Dennison and L. V. Curran, York Corp., York, Pa. In the period 1949-50, the industry, it is claimed, produced more room air conditioners than in the combined pre-war years. Barring a national emergency, the 1950-51 production will be even greater. The room air conditioner is believed to be the fastest growing branch of the refrigeration industry. High quality product control is important to continue to expand and obtain the benefits of his high potential market.

Quality must be designed into the product and must then be built into it. Inspection exists only as a check to see that production has carried out its full respon-

(Continued on page 120)



Rippon Foods, Rippon, Wis.

Fig. 1. Indraft of 100 fpm at the blending booth will confine flour dust when sack is emptied and cleaned.

Scrapbook of Exhaust Hood Design

Part 7—Control of Flour Dust in Bakeries

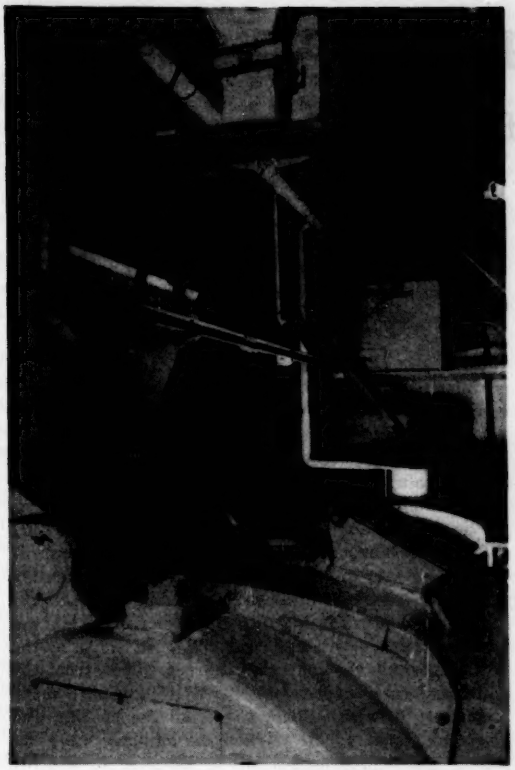
JOHN M. KANE
Chief Engineer, Dust Control Division, American Air Filter Co., Louisville, Ky.

IN the bakery, collection of flour dust through the application of local exhaust ventilation provides the advantages of usable flour salvaged and reduced housekeeping to maintain the necessary sanitation standards to prevent infestation.

The blending operation, where flour is emptied from the sacks, is the first point where floating flour particles are released. Emptying of sacks within a booth type of hood, Fig. 1, over the blending screws, with indraft of 100 fpm over the booth face area provides excellent control. (Usual volumes are 1,200 to 2,000 cfm.) Where sacks are cloth, exhaust air can be withdrawn through a central nozzle providing a sack cleaner to turn sacks inside out and thereby remove some 0.1 pounds of adhering flour from each sack.

Flour is normally conveyed from blender to overhead storage hoppers for feed to scale hoppers and subsequent transfer to the dough mixers. Local exhaust hoods similar to those shown in Fig. 2 will pick up the float dust at each transfer. Exhaust volume of 400 cfm for each hood gives good control for the usual installation. Further control in the mixer room could be supplied with a booth type enclosure where dried milk, sugar and other dry ingredients are scooped from containers, weighed, and added to the dough mix.

The dough is dusted as it travels to divider, rounder, and on to the proofer conveyor. Local hoods 12 to 16 inches by 1 to 2 inches exhausting 400 cfm at each flour dusting point are recommended as shown in Fig. 3. Similar hoods and exhaust volumes apply also as the dough is dusted while transferring from proofer to moulder and to panning machine as shown in Fig. 4. Exhaust ventilation, usually involving 3,000 to 4,000 cfm, will pick up some 1,000 pounds of flour a day from the operations shown in Fig. 3 and 4, much of which would otherwise settle on walls, equipment, and ledges and require constant removal to maintain sanitation standards.



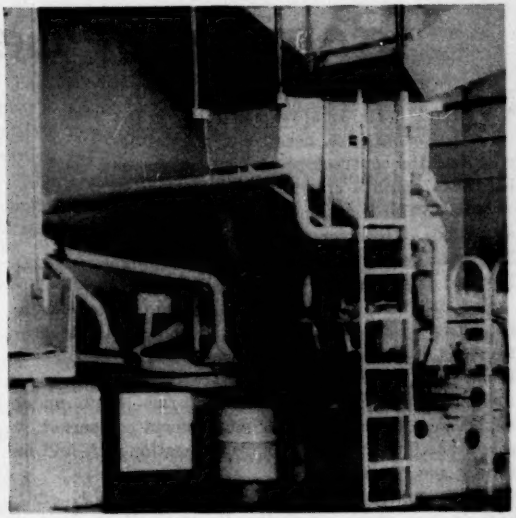
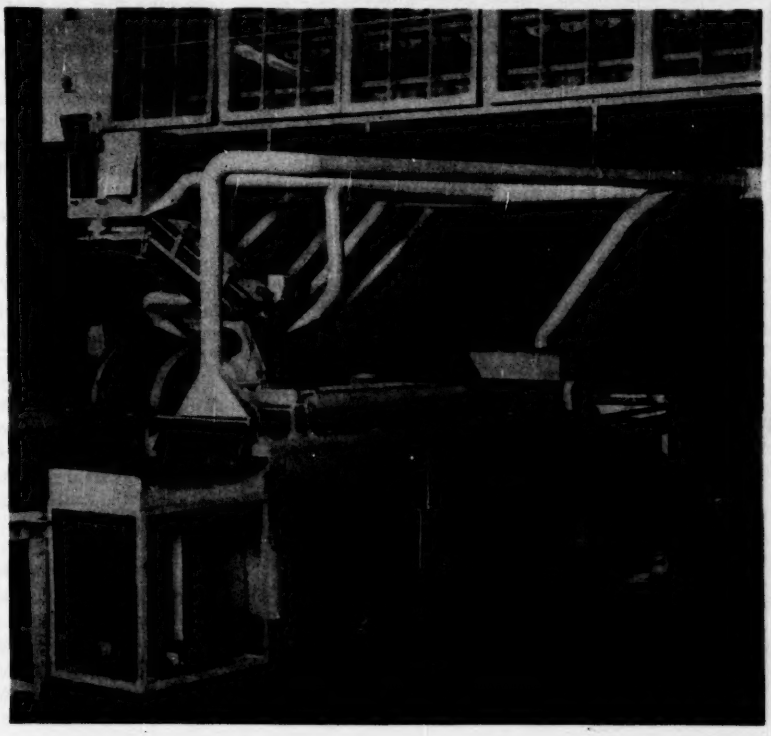


Fig. 3 (above). Local hoods pick up dusting flour as dough passes from molder to proofer.

Fig. 4 (below). Flour is dispersed at the dusting points as dough moves from proofer through rounder and to the panner.

Fig. 2 (above). In the mixing room, local hoods pick up flour dust as flour is fed from hoppers to weigh lorry, and from lorry to dough mixer.

All photos on this page, courtesy Phoenix Holsum Bakery, Phoenix, Ariz.



Review of Legal Decisions

of value to air conditioning and heating contractors

LEO T. PARKER
Attorney-at-Law, Cincinnati, Ohio

WHAT is the legal responsibility in the following case, because of a fatal accident to the contractor? A contractor was hired to install a steam boiler. He was to receive $3,250 for furnishing the materials and labor. However, he was killed while doing the work. His dependents are bringing suit for damages.

Can the employe's interests be forced to receive compensation specified by the State Workmen's Compensation Act instead of suing for damages? The answer is no. It is well established law that an ordinary or an independent contractor who performs work under supervision of his employer must accept compensation under the State Workmen's Compensation Act, and he cannot sue for damages.

For example, in Dubois v. Soule Mill, 82 N.E. (2d) 886, it was shown that the Eastman Heat Control Corp., which specialized in making surveys of heating systems of large industrial plants, made a study of the Soule Mill's plant and recommended the making of certain changes to the heating system. The officials of Soule Mill accepted the recommendations and authorized the work to be done. The Soule Mill made a contract with a steamfitter named Dubois to do the work and furnish necessary materials. Dubois was to be paid a flat sum for the job. He was injured while he performed the work. This legal question was presented the court: Can Dubois recover damages from the Soule Mill or must he accept compensation under the State Workmen's Compensation Act from the Soule Mill?

The higher court held that he could sue and recover damages, saying:

"If the work undertaken by the independent contractor (Soule Mill) is no part of the trade or business conducted by the principal, he may recover damages from him (corporation)."

For comparison, see higher court cases which hold that an injured independent contractor or employe is compelled by law not to sue for damages but must accept compensation under the State Workmen's Compensation Act, as follows: The removal of an electrical transformer in a plant, MacAleese's, 301 Mass. 25; the washing of windows in a factory, Fox v. Fafnir Bearing Co., 107 Conn. 189; the repair of an electric bell signal system in a packing plant, Hoffman v. Cudahy Packing Co., 161 Kan. 345; and the polishing of the floor, Bailey v. Mosby Co., 160 Kan. 258.

See cases in which the higher courts held that the injured employe could sue for damages instead of accepting compensation, as follows: The transportation of a steam shovel for a general contractor, Cannon v. Crowley, 61 N.E. (2d) 662; installation of a new heating system in a factory, King v. Palmer, 30 A. (2d) 549; painting of the smokestacks of a factory, T. Johnson Co. v. Industrial Commission, 306 Ill. 197.

Written Contract Valid

Recently a higher court was asked to decide this question: If a contractor signs a written contract to perform construction work at a named price, is a verbal contract valid by which the owner agrees to pay a higher price?

According to a recent higher court such oral contract is valid, if fraud is not involved. Otherwise the written contract is valid and enforceable.

For illustration, in Messick v. Smith, 69 Atl. (2d) 478, it was shown that one Messick was a discharged veteran. As such, he was entitled to make application for "priorities assistance" in purchasing materials for building a house for his own occupancy. He made a written contract with a contractor named Smith by the terms of which the contractor agreed to construct the house and furnish materials for $7,750. Smith made a contract with one Baker to install the heating and plumbing for $2,469.31. When the building was completed, Smith presented a bill to Messick for $12,731 claiming that the written contract was signed merely to give Messick an opportunity to obtain priorities on materials needed to construct the house. On the other hand, Messick testified that at no time did he agree to pay Smith more than $7,750 for the house and that he did not verbally agree to pay Smith on "time and cost" basis. The higher court allowed Baker, the heating contractor, the full amount of the contract price, saying:

"The evidence does not show participation by Baker in false representation. The decree as to Baker should be affirmed, payable out of the $4,874.80 tendered."

The court held that Smith could recover nothing more than the contract price specified in the written contract. This court said:

"The whole purpose in filling the contract was to get a priority so that he (Smith) could build the house... To permit plaintiff (Smith) to recover on a contract performed by means of priorities obtained by false representation, in which plaintiff actively participated, would be contrary to the true interpretation and application of the controlling federal legislation and regulations."

Law of Advancements

Considerable discussion has arisen from time to time over the legal question: If a salesman who sells heating equipment on a commission basis receives weekly advances from his employer, must the salesman repay to his employer money "advanced" to the salesman over the amount of his earned commissions? Accord-

ing to a recent higher court the answer is no. This is so because various higher courts have held that where a contract of employment provides for advances to the employe, which are to be charged to and deducted from the commissions agreed by the employer to be paid to the employe, the employer cannot recover from the employe such excesses or advances unless the employer proves that the employe contracted or agreed to repay the amount of money advanced over and above the commissions earned by the employe.

For example, in Harold Furnace Co. v. Junglas, 88 N.E. (2d) 586, the testimony showed: A salesman named Junglas made a written contract with the Harold Furnace Co. to sell its products. This written contract provided that the company would pay to Junglas a weekly "advance" or "draw" of $36. This was later increased to $40, plus an agreed commission on all sales. The advanced weekly salary was to be deducted from earned commission payments. Junglas worked from December 16 to February 8. The company advanced him $313.69 during this period. His commissions were $35.35. Hence the net advance or draw over earned commissions was $278.34. Junglas refused to pay this amount to the company which sued Junglas to recover this amount, plus interest.

The higher court held that Junglas need not repay the company and said:

"The record is totally lacking in evidence of any promise or agreement by Junglas that he was to be obligated to repay any amount of advances over earned commissions. The record is devoid of any evidence of conduct from which such an obligation could be implied."

Also, see Anagnosti v. Almy, 252 Mass. 492. Here the contract provided that the salesman was "to have a drawing account of $100 per week, which shall be charged against his portion of said net profits." The salesman drew $1,500 more than his earned commissions.

In subsequent litigation the higher court held that the salesman need not repay this amount to his employer.

For comparison, see Weinstein-Goodkind, Inc., v. Donovan, 26 N.Y.S. 670. This court held:

"Advances by employer in excess of commissions earned by employe are not recoverable by employer, in absence of agreement to that effect, expressed or implied."

Liability for Injuries

Recently a higher court held that a manufacturer never is liable for injuries to a contractor's employe unless the testimony proves conclusively the injury was caused by a defect in the manufacturer's product or machinery.

For illustration, in Auten v. Livingston, 207 Pac. (2d) 256, the testimony showed facts, as follows: An employe was injured when a bolt from the arm of a machine came loose and struck him in the eye. The employe sued the manufacturer of the machine for heavy damages claiming that the bolt in the arm of the machine became loosened by reason of negligence of the manufacturer to have an extra tap inserted in the slot where the bolt fitted.

The counsel for the manufacturer contended that the injury was caused by failure of the employe to tighten the bolt in the machine, and keep it tight.

The jury that heard the case believed the manufacturer's testimony and therefore held the employe not entitled to a recovery. The higher court approved the verdict, saying:

"There was no bursting of any material faulty in construction . . . The machine was not inherently dangerous and was not defective."

Contractor Followed Plans

An unusual legal question was presented a recent court, as follows: If a heating contractor follows plans and specifications prepared by an architect, who is liable if the finished job is inefficient? The answer is: According to a recent higher court the contractor is liable.

For illustration, in Brasher v. City of Alexandria, 41 So. (2d) 819, the testimony showed facts, as follows: A contractor, named Brasher, entered into a written contract to furnish "all material and labor." The contract contained a clause which provided that Brasher must perform the work in strict accordance with plans and specifications. During the course of the work, Brasher was confronted with a serious condition which required concrete cradles instead of wooden boards called for in the plans and specifications. Brasher then proceeded to lay the pipes in the trench, as provided in the specifications, using wooden boards as a stabilizer. These boards soon proved to be an inadequate brace for the load sustained by the pipes. As a result 78 pipes on this particular section collapsed. Brasher refused to make repairs stating that he had strictly adhered to the plans and specifications which specified wooden stabilizers. Then the owner employed another contractor to make the proper and necessary repairs at a cost of $13,588, and deducted that sum from Brasher's final payment.

In subsequent litigation the higher court held that Brasher was at fault although he had followed the plans and specifications. Hence, Brasher must bear the $13,588 expense of repairing the sewer pipes and installation of the concrete stabilizers. This court said:

"When a contractor enters into a contract to erect a structure in accordance with plans and specifications, which are open to inspection, there is no implied warranty or agreement on the part of the owner that the work can be done according to the plans and specifications, or that, if so done, it will be safe. It is the duty of the contractor who proposes to enter into a contract to examine the contract, plans and specifications, and to determine whether it is possible to do the work before entering into the engagement. Having made his contract, he (contractor) must fulfill it or bear the consequences of a breach."

On the other hand, it is well to know that a heating contractor may protect himself by inserting a clause in the contract that the owner "guarantees sufficiency" of the plans and specifications. Then the contractor is not responsible if he follows the plans and specifications which are in error, and results in inefficient workmanship.

Fair Labor Standards Act

According to a recent higher court, a state law is valid which limits the period employes have to sue their employers for wages under the Fair Labor Standards Act.

For example, in Kendall v. Keith Furnace Co., 162 Fed. (2d) 1002, it was shown that a state law was passed which required employes to sue for wages or for a penalty for failure to pay wages, to be brought within two years.

Certain employes sued the Keith Furnace Co. to recover back wages, penalties and lawyer fees under the Fair Labor Standards Act.

In subsequent litigation the higher court held the law valid, and that the employe could not maintain the suit since he delayed more than two years in filing it. The court said that it is not "unreasonable" as applied to suits arising under the Fair Labor Standards Act.

This court also held that an employe who delayed more than two years in suing his employer for overtime compensation and liquidated damages under the Fair Labor Standards Act is barred forever from filing the suit.

Total Disability

Recently a higher court laid down new law to the effect that if an injured employe cannot perform his regular duties, he is totally disabled.

For example, in Finch v. Ford Co., 32 N. W. (2d) 712, it was disclosed that for four years an employe was subjected to smoke, fumes and dust. He worked at various jobs such as moving hot steel castings from a furnace, chipping castings with an air hammer, cleaning out soaking pits, cleaning out open hearth furnaces, and grinding castings on an emery wheel. At times the employe became sick and found it difficult to continue his work.

The Industrial Commission awarded the employe compensation based on total disability as the employe was suffering a compensable disability, although, at most, he was only partially disabled from a dust disease.

The employer contested the award contending that the employe is not suffering a compensable disability, but is, at most, only partially disabled from a dust disease.

Nevertheless the higher court approved the commission's award, saying:

"We believe that the commission was correct in holding that plaintiff (employe) was totally disabled. The test is whether he was able to earn full wages at the work at which he was employed when last subjected to the conditions resulting in disability."

Simple Furnace Patent Valid

According to a recent higher court, simplicity of an invention will not prevent the inventor from being awarded a patent.

For example, in Hubbell, 164 Fed. (2d) 700, it was shown that for many years in the past, furnace walls were made in circular form by using firebricks with cement placed between each layer. This kind of built-in liner had a comparatively short life because, as the flame traveled over its irregular surface, the cement in the joints was caused is disintegrate and be swept away. Such conditions also affected the life of the crucible which became eroded from the impact of the direct flame. An inventor, named Hubbell, filed an application for a patent on a furnace liner which comprises an outer shell of noncombustible material into which is placed another liner. The main invention consisted of the liner being formed of a single piece of refractory material and having smooth and unbroken exterior and interior wall surfaces.

The Patent Office Examiner refused to award a patent on the grounds that Hubbell's furnace liners are old and it would not be inventive to glaze the lining.

The Federal Court disagreed and held that Hubbell's invention is patentable, said:

"When considered in the light of its accomplishment and the state of the prior art, its simplicity is the determining factor that brings us to the conclusion that the exercise of the inventive faculties was required to produce it, and that it was not obvious to one of ordinary mechanical skill . . . We think in cases where the article produced is novel, useful, and not anticipated, it should be regarded as involving the element of invention, nothwithstanding the simplicity of the inventive."

Also, see Potts v. Creager, 155 U. S. 597. Here the Supreme Court of the United State said:

"The apparent simplicity of a new device often leads an inexperienced person to think that it would have occurred to any one familiar with the subject; but the decisive answer is that, with dozens and perhaps hundreds of others laboring in the same field, it had never occurred to any one before."

For comparison, see De Lancey, 159 Fed. (2d) 737. It was shown that in the past years the electrical ignition phase of the operation of liquid vaporizing burners caused considerable trouble. One particular problem was to prevent the accumulation of carbon on the electrode which projected into the burner for heating the oil and igniting the vapors.

An inventor, named De Lancey, filed an application for an invention on arranging the electrode so that the heat from the burning vapors would continuously heat the electrode to the point of combustion and thus prevent the accumulation of carbon. The inventor's patent claims were broad. In fact, the claims recited no definite way for heating the electrode and made no reference to the required temperatures."

Although the Board of Appeals of the United States Patent Office rejected allowance of a patent, the Court of Customs and Patent Appeals reversed the decision and awarded a patent, saying that an inventor who invents something new deserves basic and broad claims in his patent.

Implied Warranty

According to a recent higher court, a manufacturer or seller of heating equipment who gives no guarantee

to a purchaser, may be liable on an implied warranty. In other words, the court will insert a guarantee clause in the contract if the testimony shows that the buyer purchased the goods for a particular purpose, known to the seller, and relied on the skill, judgment, or experience of the seller for the suitability of the goods for that purpose.

For example, in Stokes v. Edwards, 52 S. E. (2d) 797, it was shown that a company manufactures oil heaters for installation in barns for efficiently curing tobacco. The company made a contract with one retail dealer named Johnson to act as distributor of the burners in this locality. Johnson later sued the manufacturer for several thousand dollars for oil burners, and for $140, the outlay in installing them in the barns. The units were resold to farmers. The testimony showed that the oil burners proved to be wholly unfit for use in curing tobacco in that "all the heat stayed in the burners," or the burners became red hot. Therefore, the higher court held the manufacturer liable, saying:

"The seller impliedly warrants that the goods are reasonably fit for the contemplated purpose, and is liable to the buyer for any damages proximately resulting to him from the breach of this warranty."

Partnership Law

It is well established law that although only one partner is financially responsible, he can be held liable for all debts of the partnership. However, according to a recent higher court, a legal partnership never exists unless there is a definite understanding and agreement between the partners that all partners will share in both the profits and losses.

For example, in Petty v. Sexton, 206 Pac. (2d) 573, the testimony showed that one Sexton was engaged in business as a building contractor and was badly in need of materials. He paid certain outstanding obligations of one Stewart, including rent and weekly payroll of Stewart's employes. Later, various creditors sued Sexton for payment contending that he was liable as a partner in the business with Stewart.

Since no proof was given that Stewart had agreed to share profits with Sexton, the higher court held Sexton not liable for payment of debts incurred by the alleged but not legal partnership. The court said:

"There is nothing in the evidence from which an inference can be drawn that Sexton was to share in the profits of the business."

In other words, no legal partnership exists unless the testimony conclusively shows that the alleged partner shared in both expenses and profits.

Complicated Contract

Although a contract appears to be complicated and ambiguous, the court will construe it in accordance with the original intentions of the contracting parties at the time the contract was made.

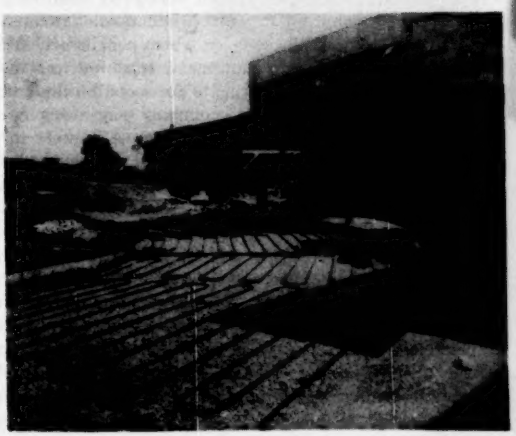
For example, in Whiting Stoker Co. v. Chicago Stoker Corp., 171 Fed. (2d) 298, the Whiting Stoker Co. sued the Chicago Stoker Corp. on a contract. The testimony showed that the latter sold its "going business" of manufacturing, selling and servicing stokers. One clause in the contract gave the Whiting Co. an option to purchase within one year, the remainder of stoker parts which it could reasonably utilize.

The higher court interpreted this contract to mean that the Whiting Co. was obligated within one year to purchase all parts that it could reasonably utilize in the future, irrespective of whether these parts were actually used during the first year. In other words, the court interpreted that the Whiting Co. must purchase during the first year, all the stoker parts it needed for several years.

The higher court decided from the testimony that this was the original intentions of the parties.

Snow Melting System for Department Store

The new nearly $3,000,000 John Wanamaker store on the Augustine cutoff, just a mile from the heart of downtown Wilmington, Del., will include an underground snow melting system to keep the walkways surrounding the store and all entrance driveways free of snow and ice. The building was designed by Massena & Dupont, Architects, Wilmington; Stewart A. Jellett Co., consulting engineers, Philadelphia, designed the snow melting system as well as the heating, plumbing, air conditioning and electrical systems; the general contractor is John McShain, Inc., Philadelphia; the plumbing, heating and snow melting contractor is Riggs-Distler Company, of Philadelphia and Baltimore.



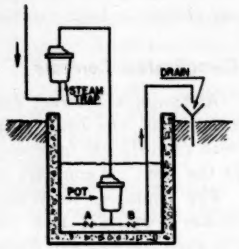
Part of the coils for the snow melting system, John Wanamaker store

PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Steam Trap Operates Sump Pump

PROBLEM: Engineers at the Socony-Vacuum Refinery in Paulsboro, N. J., wanted to remove sump from a collecting vessel near a high pressure steam source.
SOLUTION: A simple, steam trap operated pump was devised utilizing an Armstrong steam trap, two check valves, and a small pot, which in this case is an empty steam trap body. The condensate discharge from a normal operating steam trap is piped into the top of the receiving pot. From the bottom of the pot is a tee connection with a check valve on each branch. The pot and two check valves are installed in the sump below the operating steam trap. The discharge side of the checked tee is piped over the side of the sump collector to a drain. The power of the condensate discharge is sufficient to operate the check valve on the drainage side of the pot and lift the sump over the edge of the collector where it is discharged into a drain. The condensate flashes into steam in the pot and condenses to form a vacuum.



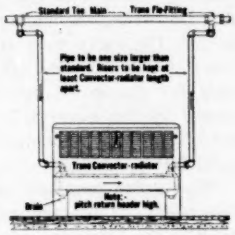
RESULTS: A siphoning action is thereby created which draws fluid from the sump through the check valve on the collector side of the pot. When the trap again discharges, this sump is forced out ahead of the condensate.

Waste Wood Licks Humidity Problem

PROBLEM: At the National Pencil Co., Shelbyville, Tenn., humidity changes proved costly by requiring extra coats of lacquer on finished products and by causing warpage of wood blocks from which pencils are cut.
SOLUTION: When a new automatic machine was installed, boosting the requirements for wood blocks and increasing pencil production, company engineers decided to install all-year air conditioning. A Servel conditioner was selected to be operated by steam. An abundance of steam could be produced by burning of surplus sawdust, a waste byproduct of pencil production. National discovered it could run 7 Servel units at almost no expense during periods when sawdust was available. At other times, gas is used as a fuel.
RESULTS: Utilizing the surplus steam, the operating cost of the Servel air conditioners is limited to the cost of electricity necessary to power a small motor and blower unit. The air conditioners are doing double duty by providing twelve-month climate control for the company's offices and manufacturing areas.

Convectors Installed in Basements

PROBLEM: Installation of convectors in basements with overhead hot water mains presents the problem of counteracting natural gravity flow without use of a separate circulator for each convector.
SOLUTION: M. J. Williams, Trane Company engineer, tells how to install basement hot water convectors in such a way as to offset the negative thermal head. Four general rules are offered: (1) oversize the pipe on down feed risers; (2) provide special flow fittings with the ability to direct water through the basement convector; (3) reduce friction by using convectors with the lowest possible resistance consistent with heating requirements; (4) design the system so that water velocity is as high as possible and consistent with good practices. Convectors above the main may be supplied adequately at mean velocities between 2 and 4 fps for highest efficiency from flow fittings.



RESULTS: With a low friction, properly fitted, down feed system, basement convectors can be installed without fear of poor circulation. Main velocity may exceed 4 fps by as much as 10% without noise.

Engine Driven Compressor for Cooling Airplanes

PROBLEM: At the new city airport at Acapulco, Mexico, cooling dry air commercial passenger aircraft standing on the flight line was to be generated at a central station and piped by a simple hose connection at each loading station. Use of electric power was considered too expensive in view of the availability of cheaper fuel oil.
SOLUTION: A Chrysler Airtemp engine driven unit was installed in the refrigeration center. These units, driven by gas, gasoline or diesel engines, fulfilled requirements for compact design and economical power. Engine driven units are fully automatic and can be supplied with a connected electric generator with which to supply the power needed for running pumps and fans.

RESULTS: Cheap fuel can be used for central station cooling independent of utility electricity.

Odorless Garbage Disposal a Must in D. C.

PROBLEM: In passing the necessary legislation for a Washington, D. C., garbage handling station near the Capitol, Congress insisted that no dust or odors be allowed to escape from this central transhipment point for some 300,000 cubic yards of refuse and garbage annually.

SOLUTION: All operations take place indoors, the municipal trucks driving up ramps and dumping their loads into waiting gondola cars and truck-trailers. The surrounding air is sucked up by huge fans and thence drawn through dust cyclones and banks of spun glass filters. If odorous it is then put through "smell collectors," hundreds of porous canisters containing activated carbon, which soak up odors much like a sponge soaks up water.

RESULTS: According to W. A. Xanten, Superintendent of the Division of Sanitation, the significant feature of the plant is that of the total cost of $918,700, the dust and odor control equipment cost but $37,400.

Heavy Pipe Supported on Prefab Steel Frames

PROBLEM: In a utility tunnel of G. D. Searle & Company, Illinois pharmaceutical manufacturers, heavy piping was to be suspended in a manner to allow flexibility for future additions or alterations.

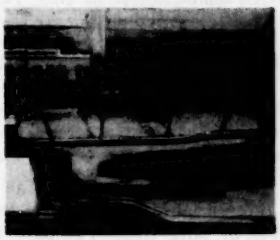
SOLUTION: A system of framing made from basic Unistrut steel channel and fittings was assembled on the job and fastened to concrete inserts embedded in the ceiling, walls and floor. Horizontal framing members fitted with roller pipe supports were inserted and pipe installed.

RESULTS: The structure is completely flexible in that variations in pitch or slope are permitted by the loosening of bolts clamping horizontal members in position. If changes or additions are desired, additional horizontal members can be added. Unistrut claims the additional advantage of a reduction of detailing time in the engineering phase and the elimination of drilling or welding during installation.

Insulation Cuts Pressing Room Heat

PROBLEM: Insulation of steam heated clothes pressers at a Hart Schaffner & Marx plant in Chicago was required to reduce the waste heat and to cut intolerable heat radiation in the working areas. Insulation was required to stick to the job without periodic repairs under severe shock and repeated vibration.

SOLUTION: The engineers and contractor selected mineral wool cement for its adhesive properties, and upper and lower bucks of the pressers were enclosed in mineral wool insulating jackets. Pressers are covered with 2 inches of mineral wool cement bevelled to a ½ inch thickness at the edges. Metal surfaces of the bucks were first prepared by cleaning. As reinforcement to reduce the possibility of damage, 1-inch galvanized wire netting was stretched over the 1-inch layer of mineral wool cement and wired securely. Two additional ½ inch layers of cement were applied over the wire netting. Each layer of cement was allowed to dry before application of the subsequent layer. The installation was finished with 6-oz canvas pasted over the cement and fitted around handle bars and frame.



RESULTS: Excessive work area heat is prevented. Less steam is required for a given press load. Maintenance is not a serious problem in spite of severe shock and vibration conditions.

Double Unit Zone Conditions House

PROBLEM: A 10-room ranch type home recently completed in St. Louis for Guy Roper was equipped with two summer and winter air conditioning units zoned so that bedroom areas and living room areas could be heated and cooled separately. The use of precast concrete joists and the requirement of an extensive duct system created problems in installing and space utilization. Twenty special branches and twelve return air inlets were necessary, and each unit was to have its own individual system of trunks and branches.

SOLUTION: To simplify duct work, heating engineer Robert Macdonald worked out a plan to heat and cool first and second floor bedrooms through an attic supply duct. This trunk is heavily insulated with 2-inch rockwool batts. Joist spaces in the basement were used for air returns. To install the necessary panning under joists, a Ramset gun was used to drive hangers into concrete joists. Two Fridg-A-Fire units were used, with the heating half of each unit using oil as fuel. The cooling system uses a compressor type refrigeration cycle. Units are manufactured by Automatic Firing Corp.

RESULTS: Engineer Macdonald says that the cost of the two stock units was economical, whereas a single central unit would have had to be custom made.

Experience is my Classroom

By T. W. REYNOLDS

T. W. Reynolds, for the past five years in charge of air conditioning, Abbott, Merkt & Co., New York, and now consultant to that firm, has contributed to HEATING AND VENTILATING for 36 years. His contributions have reflected his varied experiences, including those with the War Production Board as consultant during the last war. He has now retired, more or less, and is devoting some of his time to writing in his studio of three thousand volumes in Florida. His column, Experience is My Classroom, and more lengthy contributions will continue, as will his services as technical consultant (recently arranged) to HEATING AND VENTILATING.

His mail address is Box 121, Riviera Beach, Florida. This is on the mainland, but his invitation is open to drop in at his home, 312 Cascade Lane, Palm Beach Shores.

• SALTS CORRODE EMBEDDED PIPE

Calcium chloride is sometimes added to concrete when freezing temperatures exist or are expected, and again calcium or sodium chloride may be used for snow or ice removal over outdoor areas not equipped with a snow melting system. In such cases, piping embedded in the concrete and even that in adjacent areas may be corroded because these chlorides are highly soluble in water and in the presence of moisture promote acid conditions.

The resulting solution finds its way through very fine cracks in concrete, works around expansion joint materials, or travels through adjacent earth and fill. Contamination from salt may affect large areas adjacent to the storage, even to a depth of several feet.

In one case, weep holes and drainage gutters in an underground piping tunnel of concrete were covered with chloride deposits from an unprotected salt pile about 100 yards away. When it rained, some salt was dissolved to form a saturated solution which ended up in the tunnel where warm conditions evaporated some of the moisture, thereby depositing solid chloride crystals. In much the same way, salt solutions will travel to warm areas around embedded piping. Addition of heat to the corrosive solution will produce an acid attack on the piping.

The Portland Cement Association limits any calcium chloride addition to 2 lb per sack of cement and this primarily only for the purpose of accelerating hardening and high strength of the concrete. Even this proportion, which incidentally will not provide much protection against freezing, may set up conditions corrosive to the embedded pipes. As a substitute for calcium chloride as an accelerator, the Association suggests the use of "high early strength concrete." For protection against low temperatures they also recommend that shelter and heating facilities be adequate to maintain normal concrete at 70F for 3 days or 50F for 5 days, or to maintain "high early strength concrete" at 70F for 2 days or 50F for 3 days.

• COOLING COMPARISON

Where desk locations are fixed it might be possible to economize on quantity and temperature of supply air by doing all of the air conditioning only at the desks, rather than over the entire area. Assuming, however, no change in the supply air, air movement over the body would then be increased and the air, being less mixed, would be cooler over the body, thereby giving a lower effective temperature. While more cooling would be obtained, there would probably be more trouble from drafts, so we don't do these things. Nevertheless, the idea is a bit fascinating, and where there is a large internal heat gain with corresponding increase in total air supply, it is of interest to find out of what value the increase of air movement is.

Consulting the effective temperature chart in the ASHVE *Guide*, we find that with still air for conditions of 80F dry bulb, 50% relative humidity and 66.5 wet bulb, or 78F dry bulb, 50% R.H. and 65F wet bulb, or 78F dry bulb, 53% R.H. and 66F wet bulb, (to hold the same moisture content as at 80F), effective temperatures of 73.9, 72.3 and 72.7, respectively. Thus, by dropping the air temperature 2F, we can obtain 1.2 or even 1.6 more of effective temperature cooling. On the other hand, if we do not lower the air temperature, the air movement must be increased from 20 fpm (still air) to 120 fpm to obtain the same effective temperature as we do by lowering the air temperature only 2F.

The last case represents an increase of temperature differential between that of the body and surrounding air of only 10%. Compare this with the foregoing 500% increase in air movement required to obtain a corresponding drop in the effective temperature. Air velocities of 120 fpm are, of course, out of the question. The upper limit would be 50 fpm, giving an effective temperature drop of 0.5.

• TWINNED VACUUM PUMPS CAUSE TROUBLES

When the load on a vacuum heating job increases beyond the pump size, one should analyze the situation before adding a similar type of pump to take the additional load or before replacing the existing pump with a new one of adequate size of the same type. Thus, it is often cheaper to add a booster pump for handling

the air only and in this way better the job on the air end where most needed, leaving the condensate to be handled by the existing pump, as such pumps of the combined air and water type have excess water capacity.

Difficulties in operation are likewise avoided by such a method, since otherwise two pumps (each for air and water removal) when run together usually end up with one pump taking most or all of the load, most if not all of the time. In this way one pump may struggle along and never stop. For example, assume the usual operation of pumps cutting out at 8 inches of vacuum and in again when the vacuum has lowered to 4 inches. Then, since it is difficult to set the two vacuum pump regulators exactly alike, one pump will cut out by its vacuum regulator setting of slightly below 8 inches of vacuum, say at 7¾ inches, while the other pump has not quite reached the point (8 in.) where its vacuum regulator acts. So this other pump, being insufficient in capacity to carry the air load by itself alone (especially so with greater and continued air leakage of the system as the vacuum increases and the system ages), struggles on at 7¾ inches and never cuts out. Meanwhile, the pump which has cut out is of no assistance, since it stays out until the vacuum lowers to 4 inches.

Now, if we add a booster pump for air only we will have a pump with a much larger air capacity and can also set the existing combined air and water pump to cut out at 5 inches and in again at 1½ inches or 2 inches, while the new booster air pump can be set for 8 inches or 10 inches out and 4 inches in. Starting initially with atmospheric pressure in the system, both pumps will then run and the booster air pump will help out with air removal when most needed. When the vacuum increases to 5 inches, the air and water pump will still continue to run, although only as a condensate pump by float regulation. Meanwhile, the booster air pump will continue to run for air removal until 8 inches of vacuum is reached, when it will cut out. When the vacuum lowers to 4 inches this booster air pump will again come on, but the combined air and water pump, except by float regulation as condensate returns, will not come on for air removal, because the booster air pump will never let the vacuum get down to 2 inches. Of course, once the system had been shut down, both pumps will run together as previously mentioned for initial start up.

• WATER CONTENT OF HEATING SYSTEMS

The accompanying tables will be found convenient in determining the size of expansion tank and the quantity of non-freezing agent required. The water contained in the boiler and in one-half of the expansion tank should, of course, be included in the total.

A tank having a capacity of 5% of the water content of the heating system may be sufficient, but 10% is better. Air volume in a top story tank varies only as the water expands or contracts, but one in a lower story has its air further compressed by the static pressure due to height of water column. On the basis of 10% for a tank in the top story, a basement tank should be 13%, 17% and 23% for two, three, and four-story buildings, respectively.

WATER CAPACITY OF RADIATORS AND CONVECTORS.

No. of Tubes or Columns	Height, Inches	Lb of Water per Section
Arco Radiators		
3	19	.69
3	22	.84
3	25	1.02
4	19	1.03
4	22	1.22
4	25	1.52
5	22	1.60
5	25	1.76
6	19	1.57
6	25	2.05
6	32	2.65
Corto Radiators		
3	20	1.63
3	26	2.11
3	32	2.61
3	38	2.90
4	20	2.15
4	26	2.83
4	32	3.35
4	38	3.90
5	20	2.66
5	26	3.52
5	32	4.32
5	38	4.76
6	20	3.27
6	26	4.33
6	32	5.02
6	38	6.78
7	14	2.75
7	17	3.28
7	20	3.68
Fantom Radiators		
1	17	1.58
1	20	1.75
1	23	2.06
2	17	2.88
2	23	3.32
3	17	2.25
3	20	2.55
3	23	2.89
4	17	2.89
4	20	3.41
4	23	3.76
5	17	3.80
5	23	4.68
Peerless Wall Radiators		
5A	....	9.38
7A	....	12.25
7B	....	13.10
9A	....	15.90
9B	....	16.30

Width, Inches, About	Lb of Water per Inch of Length
Cast Iron Convectors	
4	.18
6	.25
8	.32
9	.42
Non-Ferrous Convectors	
About 2.5 lb of water per 30 sq ft of radiation.	

DEGREE-DAYS FOR NOVEMBER, 1950

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 23rd Year of Publication of Monthly Degree-Day Data

City	November			Cumulative, September 1 to November 30			Heating Season[1]
	1950	1949	Normal	1950	1949	Normal	Normal
Abilene, Texas (A)	352	214	333	361	357	333	2061
Albany, New York (A)	707	837	774	1302	1388	1292	6580
Albuquerque, New Mexico (A)	495	426	630	542	722	903	4298
Alpena, Michigan (C)	904	910	912	1585	1587	1704	8299*
Anaconda, Montana (C)	1030	710	951	2028	1841	1933	8357**
Asheville, North Carolina (C)	681	613	576	854	854	852	4232
Atlanta, Georgia (C)	525	415	396	570	479	492	2890
Atlantic City, New Jersey (C)	477	502	588	717	676	842	5176
Augusta, Georgia (A)	458	320	321	493	334	337	2161
Baker, Oregon (C)	786	660	849	1456	1510	1659	7163
Baltimore, Maryland (C)	497	488	567	705	633	790	4533
Billings, Montana (A)	984	525	909	1679	1445	1622	7119
Binghamton, New York (C)	718	778	798	1310	1293	1359	6808
Birmingham, Alabama (A)	535	430	318	579	494	318	2352
Bismarck, North Dakota (A)	1280	776	1113	2008	1694	1961	9192
Block Island, Rhode Island (C)	483	561	573	864	830	852	5788
Boise, Idaho (A)	662	613	738	1065	1279	1274	5552
Boston, Massachusetts (A)	512	644	693	942	979	1104	6045
Bozeman, Montana (C)	1004	689	1006	2032	1788	1993	8521**
Buffalo, New York (A)	777	811	774	1256	1290	1268	6822
Burlington, Iowa (A)	932	659	(a)	1222	1125	(a)	(a)
Burlington, Vermont (A)	736	950	861	1475	1525	1486	7514
Butte, Montana (C)	1076	733	923	2117	1910	1922	8235**
Cairo, Illinois (C)	664	466	519	744	654	677	3909
Canton, New York (C)	(a)	1011	906	(a)	1630	1652	8020
Charleston, South Carolina (C)	330	236	207	335	236	207	1769
Charlotte, North Carolina (C)	492	431	426	577	517	541	3120
Chattanooga, Tennessee (A)	604	521	426	672	626	531	3118
Cheyenne, Wyoming (A)	889	595	900	1564	1479	1745	7466
Chicago, Illinois (C)	843	670	696	1070	1020	1098	6077
Cincinnati, Ohio (C)	736	536	615	892	768	869	4684
Cleveland, Ohio (A)	828	710	732	1151	1119	1125	6155
Columbia, Missouri (C)	785	512	651	958	851	911	4922
Columbia, South Carolina (C)	418	348	324	462	384	355	2364
Columbus, Ohio (C)	806	636	690	1049	953	1003	5398
Concord, New Hampshire (A)	707	898	846	1433	1559	1498	7353
Concordia, Kansas (C)	766	485	693	957	823	969	5315
Dallas, Texas (A)	347	200	303	352	315	303	2256
Davenport, Iowa (C)	894	670	795	1134	1078	1158	6289
Dayton, Ohio (A)	871	691	660	1174	1109	933	5264
Deer Lodge, Montana (C)	1097	819	1055	2143	1916	2187	8672**
Denver, Colorado (C)	770	425	759	1098	952	1259	5874
Des Moines, Iowa (A)	929	643	798	1198	1055	1155	6384
Detroit, Michigan (A)	849	782	777	1239	1234	1219	6490
Devils Lake, North Dakota (C)	1369	931	1179	2218	1933	2161	9970
Dodge City, Kansas (A)	731	442	672	915	790	948	5035
Dubuque, Iowa (C)	942	729	846	1251	1223	1291	6790
Duluth, Minnesota (C)	1230	972	1074	2039	1845	1970	9483
Eastport, Maine (C)	644	835	843	1492	1499	1662	8520**
Elkins, West Virginia (A)	833	760	741	1309	1250	1182	5697
El Paso, Texas (A)	323	277	381	323	416	421	2428
Ely, Nevada (A)	776	705	(a)	1517	1567	(a)	(a)
Erie, Pennsylvania (C)	759	705	711	1101	1071	1125	6273
Escanaba, Michigan (C)	1028	907	960	1749	1676	1794	8771
Evansville, Indiana (A)	747	570	528	910	854	683	4244
Fort Smith, Arkansas (A)	535	384	408	585	582	470	3147
Fort Wayne, Indiana (A)	902	742	726	1275	1223	1073	5925
Fort Worth, Texas (A)	338	213	252	341	334	252	2148
Fresno, California (A)	211	236	315	262	379	334	2334
Galveston, Texas (C)	135	62	60	135	81	60	1016
Grand Junction, Colorado (A)	695	620	747	893	1084	1116	5548
Grand Rapids, Michigan (A)	911	776	774	1349	1226	1250	6535
Green Bay, Wisconsin (C)	1053	938	921	1691	1644	1558	7825
Greensboro, North Carolina (A)	610	541	492	784	707	635	3529
Greenville, South Carolina (A)	533	481	450	605	580	596	3380
Harrisburg, Pennsylvania (A)	646	650	660	1034	967	989	5375
Hartford, Connecticut (A)	607	728	705	1105	1117	1097	6036
Hatteras, North Carolina (C)	287	277	234	301	287	234	2571
Havre, Montana (C)	1160	662	1041	1973	1561	1931	8700
Helena, Montana (A)	1177	754	948	2065	1846	1813	7894**
Houston, Texas (C)	171	87	114	171	119	114	1157
Huron, South Dakota (A)	1117	733	1005	1659	1451	1654	8004
Indianapolis, Indiana (A)	855	682	687	1132	1058	985	5298
Jackson, Mississippi (A)	393	298	(a)	410	344	(a)	(a)
Kansas City, Missouri (A)	720	459	639	870	733	858	4956
Knoxville, Tennessee (A)	650	542	519	747	675	702	3670
La Crosse, Wisconsin (A)	1050	851	909	1518	1474	1467	7322
Lander, Wyoming (A)	1019	672	726	1792	1662	1656	7947

(a) Data not available.

[1]Figures in this column are normal totals for a complete heating season, September to June, inclusive.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Cokes Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on page 97]

Degree-Days for November, 1950 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 23rd Year of Publication of Monthly Degree-Day Data

City	November			Cumulative, September 1 to November 30			Heating Season[1]
	1950	1949	Normal	1950	1949	Normal	Normal
Lansing, Michigan (A)	925	871	861	1418	1453	1456	7048
Lewiston, Maine (O)	688	853	876	1468	1478	1542	7707
Lincoln, Nebraska (C)	848	546	753	1103	936	1069	5999
Little Rock, Arkansas (A)	507	338	381	559	480	428	2811
Livingston, Montana (C)	961	535	864	1795	1479	1614	7245**
Los Angeles, California (C)	104	66	123	106	120	123	1504
Louisville, Kentucky (A)	737	558	552	892	803	738	4180
Lynchburg, Virginia (A)	613	523	537	842	750	757	3980
Macon, Georgia (A)	433	348	324	449	363	330	2201
Madison, Wisconsin (C)	985	801	891	1393	1344	1437	7429
Marquette, Michigan (C)	1036	951	960	1761	1682	1752	8693*
Memphis, Tennessee (A)	556	425	402	614	565	464	2950
Meridian, Mississippi (A)	443	370	312	470	413	334	2160
Milwaukee, Wisconsin (A)	964	801	846	1393	1361	1380	7245
Minneapolis, Minnesota (A)	1113	836	963	1571	1423	1537	7850
Montgomery, Alabama (A)	455	286	273	462	304	273	1884
Nantucket, Massachusetts (A)	495	597	609	992	986	1007	5957
Nashville, Tennessee (A)	676	508	483	764	672	619	3507
New Haven, Connecticut (A)	588	672	693	1018	1021	1092	5895
New Orleans, Louisiana (C)	219	135	102	219	145	102	1024
New York, N. Y. (C)	519	552	594	780	728	916	5274***
Nome, Alaska† (A)	946	988	1126	1559	1541	1870	14580**
Norfolk, Virginia (C)	412	363	411	485	418	510	3350
North Head, Washington (C)	516	356	510	1193	1008	1131	5452**
North Platte, Nebraska (A)	914	599	837	1335	1207	1313	6366
Oakland, California (A)	178	246	330	354	505	603	3143**
Oklahoma City, Oklahoma (C)	527	305	459	573	514	564	3613
Omaha, Nebraska (A)	876	591	780	1155	1008	1109	6131
Oswego, New York (C)	705	810	783	1360	1263	1356	7088
Parkersburg, W. Virginia (C)	741	594	624	986	893	909	4775
Peoria, Illinois (A)	925	682	789	1178	1116	1173	6109
Philadelphia, Pennsylvania (C)	509	541	544	760	705	815	4737***
Phoenix, Arizona (C)	57	30	156	57	79	156	1405
Pittsburgh, Pennsylvania (C)	802	621	669	1084	933	982	5235
Pocatello, Idaho (A)	763	677	813	1389	1504	1468	6655
Portland, Maine (A)	699	862	807	1495	1520	1446	7218
Portland, Oregon (C)	510	369	558	952	860	995	4469
Providence, Rhode Island (C)	512	644	693	947	975	1104	6015
Pueblo, Colorado (A)	782	530	741	1024	991	1135	5514
Raleigh, North Carolina (C)	475	404	429	582	487	559	3234
Rapid City, South Dakota (A)	981	569	870	1561	1307	1529	7118
Reading, Pennsylvania (C)	573	622	669	906	881	1013	5389
Red Bluff, California (A)	257	209	(a)	361	323	(a)	(a)
Reno, Nevada (A)	579	619	714	1135	1292	1311	5892
Richmond, Virginia (C)	519	433	456	692	574	617	3695
Rochester, New York (A)	754	822	756	1272	1346	1289	6732
Roseburg, Oregon (C)	(a)	397	561	(a)	891	1022	4428
Roswell, New Mexico (A)	481	374	516	517	643	702	3484
Sacramento, California (C)	205	238	351	285	373	422	2653
St. Joseph, Missouri (A)	790	541	633	991	880	881	5161
St. Louis, Missouri (C)	769	480	597	896	725	802	4585
Salt Lake City, Utah (A)	697	624	723	1057	1202	1129	5555
San Antonio, Texas (A)	224	105	126	224	145	126	1202
San Diego, California (A)	119	80	165	124	141	199	1645
Sandusky, Ohio (C)	798	675	726	1076	994	1079	6208
San Francisco, California (C)	131	161	261	360	485	521	3264**
Sault Ste. Marie, Michigan (A)	1041	1050	978	1903	1912	1877	9285**
Savannah, Georgia (A)	351	260	201	358	261	201	1490
Scranton, Pennsylvania (C)	668	740	732	1135	1165	1189	6129
Seattle, Washington (C)	541	405	570	1050	950	1150	4934**
Sheridan, Wyoming (A)	997	585	978	1706	1514	1878	8008
Shreveport, Louisiana (A)	352	241	270	364	331	270	1938
Sioux City, Iowa (A)	975	679	870	1359	1217	1318	6898
Spokane, Washington (A)	857	713	819	1562	1512	1526	6355
Springfield, Illinois (C)	852	572	681	1026	884	2002	5373
Springfield, Missouri (A)	745	530	564	926	868	781	4428
Syracuse, New York (A)	715	809	798	1274	1286	1319	6893
Tacoma, Washington (C)	575	421	588	1164	1054	1195	5181**
Terre Haute, Indiana (A)	860	662	615	1107	1020	848	4872
Toledo, Ohio (A)	872	755	732	1258	1221	1110	6077
Topeka, Kansas (C)	719	478	639	860	765	875	4969
Trenton, New Jersey (C)	544	622	588	886	873	830	4933
Utica, New York (O)	768	847	781	1378	1224	1393	6796
Valentine, Nebraska (C)	955	624	897	1466	1336	1480	7039
Walla Walla, Washington (C)	645	518	651	1055	1025	1013	4808
Washington, D. C. (C)	520	502	594	724	673	845	4626
Wichita, Kansas (A)	672	426	636	799	703	828	4673
Williston, North Dakota (C)	1243	728	1137	2072	1787	2067	9323
Winnemucca, Nevada (C)	654	638	810	1276	1395	1509	6427**
Yakima, Washington (A)	774	641	780	1425	1315	1337	5599

(a) Data not available.

†Nome data are for October.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

[1]Figures in this column are normal totals for a complete heating season, September to June, inclusive.

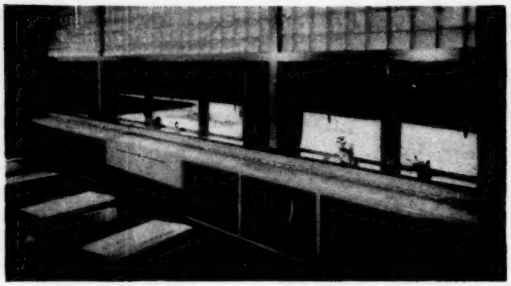
NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite Page 106 for securing additional information on items described in this department.

New School Ventilating System

A new development in schoolroom heating and ventilating, named Draft/Stop, that intercepts the chilling downdrafts encouraged by the large window areas of today's modern classrooms, is introduced by Herman Nelson Div., American Air Filter, Inc., Moline, Ill. The maker claims it to be the first fundamental improvement in school ventilation in twenty years.

Design of this new system of unit ventilation incorporates a long slot placed at the base of the windows



to catch the downdrafts before they spill onto the shoulders of students seated along the outer row of seats. This controls the captured cold air by recirculating it through the unit ventilator for heating before discharging into the room, or expels it completely from the room.

The system retains all of the comfort advantages of traditional unit ventilator systems. Automatic controls determine the amount of outside air taken into the room and how much room air is circulated. A further advantage of the system is its positive action of pulling warm air from the inside walls toward the window walls.

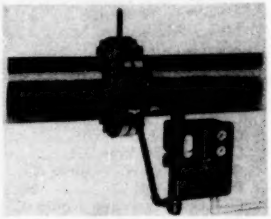
Basically, the system consists of: (1) a unit ventilator which comprises an outdoor air intake, cabinet mixing dampers, heating element, fan and motor, with filter optional; (2) flanking utility cabinets set 2½ inches from the wall and which create a cold air slot below the window and behind the cabinet to catch the downpour of cold air, and forming a duct through which the cold downdraft air passes to the unit ventilator; (3) grilles at the top of the slot and flush with the cabinet top; (4) two openings in the outside wall with Ventimatic shutters (optional) located at the opposite ends of the slot behind the utility cabinets, through which room air is exhausted, and with a frame, screen, and louvers. Room air can, if desired, be exhausted through exhaust ducts, instead of through the Ventimatic shuttered openings. The system can (a) introduce 100% outdoor air; (b) be 100% recirculating; or (c) operate on a fixed or variable ratio of outside and recirculated air.

A four-color 16-page booklet is available, profuse with illustrations, describing the system in detail.

For more information, circle on Inquiry Card, **Item 1**

Liquid, Gas Flow Indicator

The V/A cell, a precision flow transmitter, has been developed for differential pressure applications by the Fischer & Porter Co., Hatboro, Pa. The device is basically a through-flow instrument of the variable-area type, and measures a by-passed portion of the main-line flow. Continuous self-purging is thus provided. It features high accuracy with wide-range, linear scale. It is mercuryless but does not utilize a diaphragm of any kind. Manifold systems, bellows, seals, exterior purges, condensate chambers, are all eliminated.

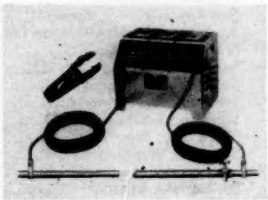


The cell is applicable to services on liquids, gas, and vapor streams, including steam; 316 stainless steel being standard material for all wetted parts. Changing the flow range of the instrument is accomplished easily.

For more information, circle on Inquiry Card, **Item 2**

Electric Pipe Thawing Device

The Therm-O-Tron, for thawing frozen water pipes and for heating pipes carrying non-inflammable liquids, has been improved and an attachment developed by the Trindl Products, Ltd., Therm-O-Tron Division, Chicago, Ill. The attachment is a low priced soldering and brazing device to be used with the Therm-O-Tron.



With the addition of the soldering and brazing attachment, the device can be used throughout all seasons of the year. To use, the pipe thawer is plugged into any convenient 110 to 220 volt a.c. outlet, clamps attached to the pipe, and the current turned on. The device comes complete and ready to use with 40 feet of output cable, two pipe clamps, 10 feet of power cord. It handles up to 30 feet of 1½ inch pipe or longer lengths of smaller pipe at one operation. Device sells for $89.50 and the soldering and brazing attachment for $19.95.

For more information, circle on Inquiry Card, **Item 3**

Low Pressure Drop Separators

A line of separators, for use in separating unwanted liquids and solids from steam, air or vapors under pressure or vacuum, is announced by The Swartwout Co., Cleveland, Ohio.

Operating on the helico-centrifugal principle, these separators have a smooth helix that gives the steam or air a positive whirling motion which throws the undesired liquids and solids against the wall of the separator, where they run down to a drip pocket. The separation process takes place with virtually no pressure drop. Positive action of the separators assures that slugs of water will not be carried into the engine or turbine and oil and grease will not spoil work in process or gum up pipes.

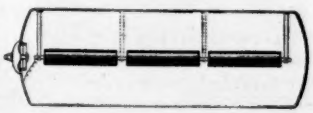
The units are made in a variety of styles and sizes. Those made of high tensile cast iron are for use with 50, 125 and 250 lb steam, and those made of cast carbon steel are for use with 150, 300, 400 and 600 lb pressures. Sizes range from 1½ to 24 inches. They are available in horizontal (illustrated) and vertical styles.

For more information, circle on Inquiry Card, **Item 4**

Anodes for Large Tanks

Anodes for tank protection for tanks up to 2,000 gallons are now available from Elno Division, The Cleveland Heater Co., Cleveland, Ohio. The new line consists of 3 inch Elno anodes.

The 3 inch anodes are made up from basis unit sections 21 inches long. These unit sections are rigidly coupled together to form multi-section anodes in whatever combination of unit sections and half sections comes closest to the length of the tank being protected. One or more of these multi-section anodes are used in a tank, depending upon its size.



Two methods of installing the anodes are used. If the tank has a manhole, the anodes can be mounted on hangers suspended inside the tank. If the tank does not have a manhole, 3 inch tappings have to be provided in either head of the tank. The anodes are then furnished with 3 inch plugs.

For more information, circle on Inquiry Card, **Item 5**

Thermostat Heater Selector

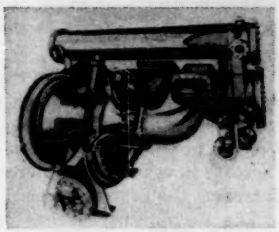
A unique slide rule selector to aid in choosing the proper heater for every thermostat replacement job has been designed and introduced by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

The selector recommends, on one side, heaters for use with Honeywell primary controls; and on the other, heaters for use with controls of other manufacturers. It can be used for trouble-shooting where the burner is not cycling properly.

For more information, circle on Inquiry Card, **Item 6**

Centrifugal Water Chiller

The CenTraVac, a centrifugal water chilling unit, has been introduced by The Trane Co., La Crosse, Wis. The company claims substantially lower maintenance, operating and installation costs for this unit in a wide range of comfort and industrial air conditioning systems. It is said to be the first hermetic centrifugal refrigeration unit designed for the market served by compressors with capacities of 45 or more tons of refrigeration.



Because the compressor-motor assembly is shipped hermetically sealed from the plant, the bulk of the installation work can be done by steamfitters and electricians. The refrigerant used is F-113, one of the Freon refrigerants. Maintenance economies stem from the hermetic sealed design of the two-stage compressor-motor assembly (left foreground). This eliminates shaft seals, a major source of gas and air leakage and compressor failures, which must be replaced annually on many compressors.

Quiet operation and elimination of vibration are gained through direct drive, which eliminates gear boxes, sources of noise and friction. Impellers for both stages of compression are mounted directly on the constant speed motor shaft.

Operation is said to be so free of vibration that the unit can be installed on any floor that will support its dead weight, without special foundations. This cost-saving feature is particularly important in air conditioning existing buildings.

Most important contributor to operating economy is the capacity control or unloading system, composed of variable vanes in the inlets of both low and high compression stages. This system assures smooth efficient operation from 100% down to approximately 10% of capacity.

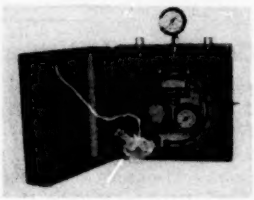
The unit can be started or stopped by push button control, or controlled thermostatically to modulate, stop and start automatically, thus maintaining a constant temperature in the cooling water supplied to the air conditioning system.

The unit will be manufactured initially in five sizes with capacities as follows: 45 to 55 tons, 65 to 95 tons, 95 to 125 tons, 115 to 155 tons, and 140 to 190 tons. The company plans ultimately to produce much larger sizes.

For more information, circle on Inquiry Card, **Item 7**

Fume Hood Velocity Controller

A new, proportional action velocity controller, for controlling air velocities ranging from 50 to 250 feet per minute, has been developed by Johnson Service Co., Milwaukee, Wis. It is designed primarily to control the velocity of air through the doors of fume hoods employed in working with radioactive materials, where a fixed velocity is required with variable door openings. It already is being used in atomic energy and cancer research projects.



Operation of the instrument is based on the fact that the velocity of air, moving between two points, is proportional to the difference in pressure between those points.

This extremely sensitive regulator responds to pressure variations of .0001 inch water gage, and controls velocities within plus or minus 10 feet per minute. Control pressure increases in direct proportion to the increase in velocity. An increase of 10 feet per minute increases the control pressure 1 lb per sq in.

The instrument consists of a very light, flexible diaphragm, operating a pneumatic control mechanism. One side of the diaphragm is exposed to the pressure within the laboratory, and the other side is connected to an averaging pressure tip located within the fume hood.

Thus, the diaphragm responds to the difference in pressure which causes flow through the hood door and automatically takes into account which of the two pressures is higher. Proper control of the direction of flow, as well as the difference in pressure, is assured.

The sensing diaphragm actuates a lid which opens and closes a leakport. The pressure difference on the diaphragm results in a proportional leakport pressure. The leakport pressure, in turn, actuates a pilot type relay which varies the control pressure to the damper or other controlled device.

For more information, circle on Inquiry Card, **Item 8**

Bilge Pump and Clutch Unit

A finger-tip control pump and clutch unit, Model 2300, is available from Jabsco Pump Co., Burbank, Calif. The unit is particularly suitable for bilge pumping and other installations where a clutch-operated unit is desired. The unit consists of a Model 777 1 inch Jabsco pump with built-in friction cone type clutch with sheave for V-belt operation.

Principal design features include a self-priming bronze pump with flexible neoprene impeller, over-all length of less than 6½ inches, sealed and pre-lubricated ball bearings, used in both pump and clutch, auxiliary seals to insure against any moisture entering bearings, finger-tip control, and suitable for remote control.

The unit is suitable for operation up to 3,600 rpm, at which the pump will deliver 39 gpm against a 20 foot head.

For more information, circle on Inquiry Card, **Item 9**

Low Capacity Spray Nozzles

Extremely fine and uniform fog droplets at low operating pressures are claimed for a new line of low gallonage spray nozzles by the manufacturer, Bete Fog Nozzle, Inc., Greenfield, Mass.

Employing the pin-jet impingement principle, the new nozzles have no internal parts and cannot clog with foreign particles smaller than the orifice size, according to the manufacturer. A new pin design reduces interferences of the pin with the fog pattern, a defect said to be common to previous nozzles of this type.

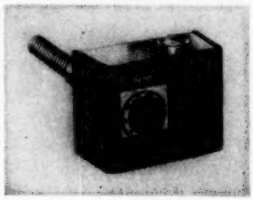
The nozzles are made in 10 orifice sizes from .015 to .080 inch diameter with flow rates from 1 to 100 gallons per hour. They are available from stock in brass with stainless steel pins, and made to order in various other metals.

For more information, circle on Inquiry Card, **Item 10**

Fast-Acting Immersion Control

A line of hot water immersion controls, especially quick in their response to temperature change, has been introduced by Penn Electric Switch Co., Goshen, Ind.

Designated as the Series 442 liquid expansion hot water control, the new line incorporates a self-compensated power element which is not affected by ambient temperatures and which makes possible an exceedingly rapid response of the control to changes in water temperature.



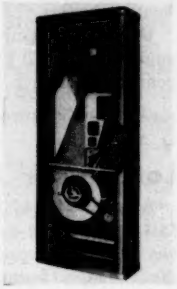
Designed for the new small fast-acting hot water boilers, the Series 442 features close differential and easy-to-read calibrated dial on which both cut-in and cut-out points are easily adjusted.

Rated at 7.4 amp for 115 volts and 5.1 amp for 230 volts, the line is available in a high limit model in which the contacts close on temperature rise, and a low limit model in which the contacts close on temperature drop. Both models can also be had with special immersion element for remote mounting.

For more information, circle on Inquiry Card, **Item 11**

Furnace, Wall, Space Heater

The Model GHSS gas-fired furnace, with a base requiring less than 3 square feet of floor space, is introduced by Ingersoll Products Div., Borg-Warner Corp., Kalamazoo, Mich. This unit serves as a vented wall heater as well as a space heater or utility furnace.



Used as a furnace, heat may be delivered in any direction through ducts connected to front, sides, back, or top of cabinet. Installed as a space heater, the low resistance grilles are said to allow maximum warm air circulation with minimum resistance. The compactness is due to the inclusion of a wedgetube heat exchanger. Installation costs are held to a minimum through the use of a built-in plenum chamber and draft diverter. Assembly includes the wedgetube heat exchanger, blower, filters, raised drill port burners, and fully automatic controls.

It is approved for use as a vented wall heater and forced air furnace for use with natural, mixed, manufactured, LP, and LP-air gases.

For more information, circle on Inquiry Card, **Item 12**

Pump Sprays Coatings Evenly

Spray gun spurting, which projects a blob of heavy material upon the coated surface, is eliminated by the Graco Mogul-Type Powerflo pump, made by Gray Company, Inc., Industrial Div., Minneapolis, Minn. This air - operated, high volume, material handling pump is equipped with a device called the Evenflo which prevents spurting, so that surfaces can be coated evenly to meet rigid specifications.

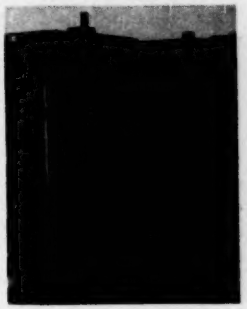
These pumps, operating in 400 and 100-lb drums or in bucket-type containers, supply industrial material through hoses for spray gun, pole gun or extrusion gun application. No time-wasting transfer operations are necessary. Rust and corrosion preventives, calking compounds, adhesives, sound deadeners, roofing materials, undercoaters, and other industrial materials are pumped rapidly and in great volume with the pump. Even gummy mastics, and other non-self-leveling substances, can be easily handled.

The pumps weigh 35 lb. Power head is cast aluminum. Air motor incorporates steel forgings and machined castings for durability, large poppet valves for greater efficiency.

For more information, circle on Inquiry Card, **Item 13**

Packaged Cooling Tower Line

A packaged cooling tower has been introduced by Lilie-Hoffmann Cooling Towers, St. Louis, Mo., and available in 10 sizes with capacities ranging from 1.9 to 60.6 tons of refrigeration, depending on the model and on conditions.



The towers are of cylindrical construction, making for a compact unit, and are said to achieve accuracy of performance and trouble-free operation. Distribution system consists of a galvanized wrought iron main pipe header and galvanized lateral arms. The main pipe terminates approximately 6 inches beyond the outer tower edge for the purchasers' connection. To each lateral arm, there are attached bronze spray nozzles of the non-clogging types, arranged to distribute evenly the water in fine drops throughout the tower.

Filling and drift eliminators are constructed of redwood and are free to contract or expand without warping or sagging. Filling and eliminators are readily removable in sections for cleaning or maintenance.

Steel fan blades are furnished on the smaller towers and cast aluminum on the larger towers.

For more information, circle on Inquiry Card, **Item 14**

Perimeter Heating Diffuser

A slim floor diffuser intended primarily for perimeter heating, is being made by The Lima Register Co., Lima, Ohio. The nominal size is 2 x 14 inches and it is deep enough to allow space for sub-floor, pad and carpet. It is designed to spray warm air on large windows to counteract drafts, or for putting a flat spray of air in any definite area. It fits in window sills, or in the toe-space under kitchen cabinets, and is neat and inconspicuous in any location.

This diffuser has an easily adjustable set-screw for balancing the system which stops the damper in the predetermined balanced position. Damper is opened or closed by an inconspicuous lever. It will handle a wide range of capacities up to 250 cfm, making it useful for commercial as well as residential installations.

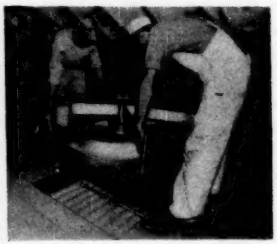
Vanes are close together for precise diffusion pattern control and can be adjusted to vary the shape of the diffusion pattern. Heavy steel construction, welded throughout. It has a metallic bronze finish.

For more information, circle on Inquiry Card, **Item 15**

Attic Fan Installed in Hour

Attic fan installation is said to be greatly simplified by a new package fan introduced by Robbins & Myers, Inc., Memphis, Tenn.

This vertical discharge unit with built-in suction box measures 3 feet square and projects 17½ inches above the attic floor.



These dimensions make it suitable for use over narrow hallways and in low attics. Installations can also be made over the kitchen or other rooms, depending on construction. In new construction, the fan can be installed in less than an hour. All that is needed is a ceiling opening and adequate exhaust areas. Fan, motor and suction box are all in one unit that rests on the attic floor. Heavy rubber bases provides an air seal and cushion between fan frame and attic floor.

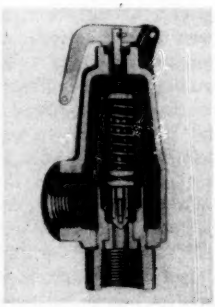
Package includes an automatic ceiling shutter, operated by a wall switch. This shutter is installed by attaching to wood frame of ceiling opening, with no extra plastering, papering or painting. Shutter and trim are finished in light ivory to harmonize with any room color.

This package fan is available in 4,750 and 6,800 cfm capacities, with air delivery ratings certified.

For more information, circle on Inquiry Card, **Item 16**

Water Heater Safety Valve

A moderately priced, large capacity safety relief valve for domestic hot water heaters and tanks has been developed by McDonnell & Miller, Inc., Chicago Ill.



Designed to fill the vital need for a valve that will prevent excess pressure under every condition that can develop in a hot water system, each valve in this new series 3345-33150 is rated in Btu capacity. With this rating it is possible to select the valve that will open at the desired pressure and that has capacity equivalent to the heat output of the firing means.

Operation of the valve is simple. At normal temperature, water is relieved at a low rate; but when temperature rises into the emergency zone the increased velocity acts on the Hydralift ring, snapping the valve wide open to dissipate heat at full discharge rating.

Valve needle is stainless steel, hardened and precision ground to polished finish. Seat is also stainless steel, machined and reamed to exacting tolerance. All working parts are corrosion resistant. Testing lever is easy to lift, and operates independently of automatic action so that it is not disturbed by automatic opening of the valve in service.

These valves also are capable of handling the need for dependable rated safety relief valves on hot water heating boilers designed for higher working pressures.

Opening pressures are 45, 75, 100, 150 pounds per square inch. All inlet connections are ¾ inch; outlet connections are 1 inch.

For more information, circle on Inquiry Card, **Item 17**

Latches for Access Doors

A new series of Tite-Seal flush latches, designed for fast opening and closing of inspection and access doors, has been developed by Aircraft Hardware Division, Modern Metal Spinning & Mfg. Co., Los Angeles, Calif.

The latch employs an over-center or toggle action movement to assure positive door closing. Once in closed position, doors equipped with the new latch can only be opened accidentally by forces large enough to cause structural damage. To open normally, only finger-tip pressure is required. Rubber gaskets around latch openings make the latch splash-proof and moisture resistant.

Providing a flush surface, the new latch is used on metal cabinets, doors and access openings on furnaces and air conditioning equipment, and vent and access doors on refrigeration units.

Designed for economy, the latch has fewer parts than conventional latches, and costs are substantially less. It is light in weight, weighing only 1 ounce, and is ruggedly made of corrosion-resistant stainless steel, Over-all length is 3⅛ in.

For more information, circle on Inquiry Card, **Item 18**

Expansion Tank-Water Feeder

The Capco combination expansion tank and automatic water feeder for hot water heating systems is being marketed by Charles A. Perpall Co., Los Angeles, Calif. It can be used with any hot water system but was designed primarily for use with slab floor radiant heating systems.

Combination consists of (a) an open steel tank 9 in. dia. x 18 inches with an expansion capacity of 3.3 gallons; (b) an automatic water valve at the top of the tank and operated by (c) a float and connecting rod. The tank can be located on top of the boiler without the use of hangers. It meets requirements of plumbing codes as to anti-siphonage.

Advantages include elimination of specialties needed if system is a closed one, as well as the pipe work involved. Trade price is $22, f.o.b. plant.

For more information, circle on Inquiry Card, **Item 19**

Non-Freeze Heating Medium

A variant of S/V Heat Transfer Oil has been designed for snow melting systems and recently introduced by Socony-Vacuum Oil Co., Inc., New York 4, N. Y. Known as S/V Sovaloid S, the oil is being used in a large bus terminal ramp snow melting system for the first time, and is similarly suitable for installations for controlling ice and snow on airplane runways, parking areas, highway grades, and sidewalks.

S/V Sovaloid S has a pour point of —40F. Unlike anti-freeze, which is used in solution with water in snow melting systems, the oil is used as the sole heat transfer medium, undiluted, in the system. It is relatively low in cost and is non-corrosive.

Other properties of the oil include: specific gravity at 60°/60°, 1.00; flash point 260F minimum; kinematic viscosity in centistokes at 50F, 10.0; at 0F, 48.0, and at —10F, 70.0; coefficient of expansion, .00035 per deg F; specific heat at 100F, 0.43; at 60F, 0.42; and at 0F, 0.39.

For more information, circle on Inquiry Card, **Item 20**

Balancer Made of Stock Tees

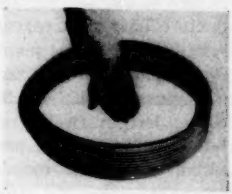
An adapter to balance water flow in forced hot water heating systems, and which makes a balancing valve out of any stock copper or bronze tee, is announced by Maid-O'-Mist, Inc., Chicago 41, Ill. The balancing valve unit is inserted in the side outlet of the tee to make a straightway balancing valve, or in the direction of flow making an angle balancing valve. Consequently, separate balancing cock stocks are not necessary.

The balancing adapter is made in ⅜, ½, ¾ and 1 inch nominal pipe sizes. Simple balancing adjustment is made through the screwdriver slot which may be locked in place.

For more information, circle on Inquiry Card, **Item 21**

Stainless Steel Bellows

Hydraulically formed stainless steel bellows in a wide range of sizes from 7/16 to 26⅜ inches diameter are now available from Clifford Mfg. Co., Waltham, Mass.



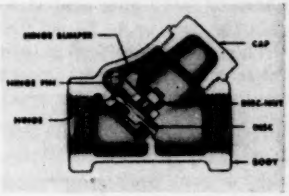
The flexibility, strength, corrosion resistance and leakproof qualities of hydraulically-formed stainless steel bellows make them well suited for applications involving the control of temperature and pressure, shaft sealing, steam traps, providing flexible joints for instruments which combine rotary motion and hermetic seal and the transmission of movement hydraulically to remote points.

In the larger sizes, stainless steel bellows are ideal for expansion joints for large jet engines and gas turbines. They are available to customer's specifications.

For more information, circle on Inquiry Card, **Item 22**

Brass Regrind Check Valves

A new line of Y-pattern brass swing check valves has been announced by Crane Co., Chicago, Ill. The new valves, of the regrinding type, are in the 200- and 300-lb pressure classes. Screwed-end patterns are available in sizes ¼- to 3-inch, inclusive; flanged-end patterns in sizes 1- to 3-inch, inclusive.



Many improvements over the usual regrinding check valve are included in the new design. A large cap opening on the same center line as the seat opening permits easy access for regrinding or replacement of parts. Easy contours in the Y-pattern body offer minimum resistance to flow. Closure on backflow is fast and positive.

The new check valves can be used on lines where flow is horizontal or upward. They should be installed with the inlet under the seat, as indicated by an arrow cast on the body.

For more information, circle on Inquiry Card, **Item 23**

Portable Heater Burns L. P. Gas

A former contractor, who got tired of catching cold while working on winter construction jobs, has developed a portable heater to aid in preventing cold-weather work slow-downs. The heater, product of The Portable Heater Company, Cleveland, Ohio, is capable of raising the temperature of a cold room from 30 to 80 degrees within 20 minutes—without odor, fumes, grease, or smoke. The heater enables workmen entering a cold building or one under construction to have comfortable working conditions within a few minutes.

Weighing 55 pounds, and designed for easy, economical operation, the heater needs no manual pumping. Bottled gas is held under pressure in a 20-pound cylinder. Tests show that fuel costs average $1 per day for continuous 8-hour operation.

For more information, circle on Inquiry Card, **Item 24**

10 G.P.M. Portable Pump

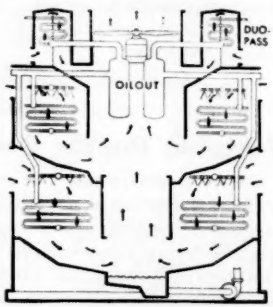
A close-coupled electric motor and pump unit, Model 2187, has been placed on the market by Jabsco Pump Co., Burbank, Calif. The unit consists of a bronze self-priming pump with neoprene impeller, with ½ inch inlet and outlet ports designed to accommodate standard female hose couplings, mounted direct on the shaft of a ¼ hp Wagner, 1,725 rpm, 115 volt, 60 cycle, single phase capacitor motor with overload protection, complete with 8-foot extension cord. The unit is compact and weighs 25 pounds net. Capacity is 10 gpm against a 10 ft head. It is suitable for uses up to 20 psi pressure.

This portable self-priming unit is particularly useful in industrial, farm, plumbing and marine applications, and is suitable for transferring all liquids that will not affect bronze and neoprene.

For more information, circle on Inquiry Card, **Item 25**

300-Ton Refrigeration Condenser

A high capacity Aeropass condenser, built to serve large refrigeration plants, is announced by Niagara Blower Co., New York, N. Y. Its nominal rating is 300 tons, and in field tests approximately 350 tons capacity is reported. It is similar to smaller units made by the manufacturer, and embodying the company's Duo-Pass precooling coil.



As shown on the accompanying diagram, the refrigerant gas first passes through the precooling coils on top of the structure to remove the superheat and reduce gas temperature close to its condensing point. This coil also condenses entrained oil vapors, providing an ideal point for removing oil from the system by the Oilout separator drums which are next in line. The gas then passes to the condensing coils where it is condensed by the evaporation of a strong water spray.

Since the superheat has been previously removed there is no tendency for salts to precipitate and clog the condenser coil banks. As only the water evaporated is consumed, large water savings are made. Also, savings are obtained in the use of space and in piping, pumping and operating horsepower.

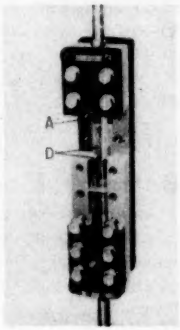
Air is drawn through the condenser by a large propeller fan. It enters through screened ports arranged so that the correct proportion of the air stream passes through the two precooling Duo-Pass coils and the four sprayed condensing coils. The spray water falls to a tank at the base from which it is recirculated by a pump.

The equipment is compact, measuring 14 x 13 feet in length and breadth and 18 feet in height. Weight is approximately 20 tons and the largest section weighs 4 tons. Recommended application is to refrigeration plants above 400 tons capacity, so that the operator may obtain the economy that a multiple unit installation gives by varying condensing capacity with the actual refrigeration load.

For more information, circle on Inquiry Card, **Item 26**

Improved Water Gage Gasket

When glasses or gaskets of the company's high pressure water level gages are replaced, Yarway flat glass inserts are now fitted with improved Frelon gaskets according to Yarnall-Waring Company, Philadelphia, Pa. These gaskets are coated with a special compound that prevents them from adhering to the gage metal surfaces under high pressure and high temperature service.

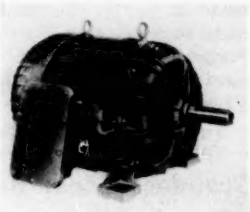


The compound used on these gaskets, shown in *D* of the photo, is used also on asbestos cushioned gaskets between the cover plate and outer surfaces of front and rear flat glasses as shown at *A* in the photo. Other details of the pressure sealed floating assembly are also shown in the illustration.

For more information, circle on Inquiry Card, **Item 27**

Explosion-Proof Motor Line

A line of explosion-proof motors, approved for Class I, Group B; Class II, Group F; and Class II, Group G, hazardous locations, is announced by Crocker-Wheeler Div., Elliott Co., Ampere, N. J.



These motors, of totally enclosed, fan cooled design, are accepted for use in atmospheres containing gasoline, petroleum, naphtha, benzene, butane, propane, alcohols, acetone, benzol, lacquer solvent vapors, natural gas, carbon black, coal or coke dust, flour, starch or grain dusts. They are especially adapted for service in refineries, chemical plants, grain elevators, or wherever explosions are a hazard.

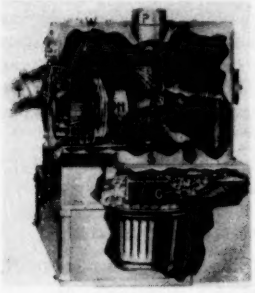
The motor is an adaptation of the company's Sealed-power design. Cooling air is directed by an external fan over fins which are cast into the corrosion-resistant grey cast iron frame. There are no internal passages to clog and cause overheating. It is available in NEMA frames 364 through 505.

For more information, circle on Inquiry Card, **Item 28**

Automatic Anthracite Boiler

A new and larger Anthratube, Model 260-M (upper photo), has been introduced by Axeman-Anderson Co., Williamsport, Pa. It has a capacity of 260,000 Btu per hour, twice as much as the Model 130-M which has been on the market for some time. It is intended for large residences, small apartment houses, churches, schools, greenhouses and similar applications.

Both models of this anthracite-burning boiler are similar in that they burn the fuel automatically without shoveling, practically eliminate ash dust, and require no grate shaking. The anthracite is carried from the bin through the coal tube *T* (see lower photo) by a hollow worm to the transfer head *C* from which it falls onto the grate *G*. The grate is set in motion or stopped by a heat sensitive ash switch which is actuated by the radiant heat in the ash; weight of the coal on the fire bed forces coal onto the grate, and as the grate moves forward and back the ash is deposited in the ash bin at the bottom.



Hot combustion gases swirl through the centrifugal heat absorber *H*, motivated by an induced draft fan *F*, and discharge into a cyclone separator *S* which absorbs further heat from the flue gases, extracts the fly ash and drops it down to the grate. The flue gas then passes to the smoke pipe *P*.

Built-in domestic water heating coils, *W*, are provided in several sizes. Advantages of the device include that of burning low price fuel, extracting greatest possible amount of heat from the fuel, automatic features, and cleanliness.

For more information, circle on Inquiry Card, **Item 29**

Adhesive Metal Nameplates

A self-adhesive metal nameplate, Metal-Cal, requiring no pre-drilling of holes, screws, rivets or other fastening devices, has been announced by C & H Supply Co., Metal-Cal Div., Seatle, Wash.

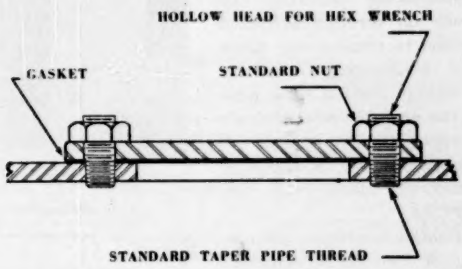
Consisting of a .0003 inch thickness of aluminum foil anodized and dyed, these plates are backed with a high tensile bonding material, and can be quickly applied to any smooth, cohesive surface on metals, porcelain, bakelite, polysterene, glass, wood, paints or enamels.

For more information, circle on Inquiry Card, **Item 30**

Stud Reduces Tank Costs

A self-seal tank stud, designed to reduce tank manufacturing costs, is announced by Donear Products Co., Rockford, Ill. The stud has pipe threads on one end, standard threads on the other.

The pipe thread forms a seal for the stud when



screwed into a section where liquids are held. The standard threaded section allows fastening of a fluid-tight cover using a gasket and nuts. In addition to its use as a cover stud, there are many uses to which it may be placed, such as for fastening brackets to tanks.

Illustration shows use of studs on a tank. The old method employed a frame, welded to the tank, which had to be blind drilled and tapped, and with a finished surface at the joint.

For more information, circle on Inquiry Card, **Item 31**

Valve Has Stainless Parts

Completing its line of Micro-Control valves, The Fairbanks Co., New York, N. Y., introduces the Fig. 0525 150-lb bronze globe valve, with stainless steel plug disc and seat, heat-treated to a hardness of 500 Brinell.

The stainless steel plug disc and seat are manufactured as a unit, precision-ground for close control of flow and perfect seating; they may be reground, and replacement discs and seats are available in matched sets. Resistance to corrosion, wire drawing or damage due to solid particles in the fluid flow contribute to the life expectancy of these valves.

The two-piece union bonnet and the radial seat insure a perfect body bonnet joint, rigid alignment of all parts, and easy access to plug disc and seat for regrinding or replacement.

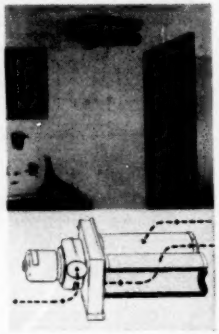
The Micro-Control series now covers the 150-, 200- and 300-lb classes of valves.

For more information, circle on Inquiry Card, **Item 32**

Air Purifier for Lavatories

An activated carbon air purifier, for lavatory and toilet area applications, is being marketed by W. B. Connor Engineering Corp., Danbury, Conn.

Called the Air Improver, the unit is essentially an indoor ventilating device. Continuously drawing the room air through activated carbon to remove any odors and discharging a steady stream of treated air, it adds to the normal ventilation air supply. The device does not change the air in any way except to filter out impurities.



Design is simple, consisting of two metal canisters containing 3 pounds of activated carbon, and a quiet 3,000 rpm motor-blower which circulates the air at the rate of 60 cfm. In a room measuring 1,000 cubic feet this would mean that all the air in the space is completely treated 3½ times an hour. Over-all length is 18 inches and it may be fastened at any convenient spot. It uses no more electricity than a small light bulb.

The device is a simple and economical answer to a frequent air sanitation problem in offices, restaurants, hotels, and theaters, or any small space where ventilation may be lacking or impractical.

For more information, circle on Inquiry Card, **Item 33**

Perimeter Slab Insulation

Fiberglas perimeter insulations for concrete floor slabs in residential construction have been announced by Owens-Corning Fiberglas Corp., Toledo, Ohio. The product, formerly identified as floor slab edge insulation, is gaining wide acceptance as perimeter insulation for new homes built without basements. During the heating season perimeter insulations make possible reduced fuel bills. And greater comfort is afforded through warmer floors. Heating coils or perimeter heating with warm air in the slab increase the need for perimeter insulation.

There are three types of Fiberglas perimeter insulation as follows: Type PF-615, 12 x 48 x ⅞ in., with a thermal conductance of 0.31 Btu per hr sq ft per deg; Type AE-6, 12 x 36 x 1 in., thermal conductance .028; Type AE-618, 12 x 36 x ¾ in., thermal conductance 0.33.

For vertical installation the perimeter insulation is installed prior to back-filling the foundation trench. Normally, the back fill will hold the insulation in place. Otherwise temporary braces or occasional nailing below grade suffice until the back fill and underbed are in place. In a horizontal installation the foundation is back-filled and the gravel or crushed stone underbed is tamped firmly in place. The insulation is laid on the underbed, butting edges close to each other and to the foundation walls. Vertical pieces are installed around the inside of the foundation and braced temporarily in position. The waterproof damp course is laid, if specified, and any required reinforcing. Then the slab is poured against the vertical insulation and over the horizontally insulated area.

In exterior installation for existing commercial and industrial buildings, house construction, and those buildings having a floating slab, perimeter insulation may be applied to the exterior of the foundation and carried 12-inches or more below grade.

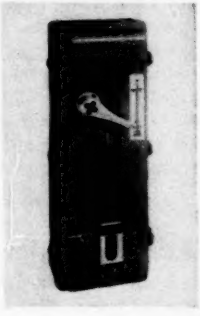
After the outside face of the foundation is cleaned and primed with asphalt primer, the insulation is adhered with cold asphalt mastic or hot asphalt. Metal flashing is installed above the top course of the insulation and the exposed face adequately protected.

The Type PF-615 is a low-cost inorganic fibrous board. It may be used as an integral part of the form if dry mixes are used but a damp course between the insulation and the slab may be provided wherever specified. Type AE-6 has an insulating core of Fiberglas preformed insulation completely enclosed in an asphalt sheath which shields the insulation from absorption of water in the concrete mix and during the pouring of the slab, and from ground water.

For more information, circle on Inquiry Card, **Item 34**

Motor Starter-Circuit Breaker

A new combination Life-Linestarter, Class 11-206-N, combining motor starter, motor protection, and disconnect in a redesigned enclosure to save space and increase safety, is now available from Westinghouse Electric Corp., Pittsburgh, Pa.



Designed for across-the-line starting of squirrel cage induction motors, or as a primary switch for wound rotor motors, this unit features the new De-ion circuit breaker, and slamproof self-indicating interlocked handle.

With capacities from ¼ to 100 hp, and 110 to 600 V polyphase, the unit is available in NEMA sizes 0 through 4, and NEMA type enclosures, 1, IA, 3, 4, 5, 7, and 9.

The starter component provides fast, trouble-free operation due to the simple action of a see-saw pivoted on a knife-edge bearing with a kick-out spring to insure positive opening.

Delayed tripping of safe overloads, and instantaneous action on short-circuits is provided by the quick-make, quick-break thermal-magnetic circuit breaker.

For more information, circle on Inquiry Card, **Item 35**

PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on:

- **News of Equipment and Materials**
- **New Catalogs**

Circle the Item Number in which you are interested and print clearly your name and address with title.

NEW CATALOGS

SELECTING METAL BELLOWS

An informative bulletin on What to Consider When Selecting A Metallic Bellows, written by its engineers, has been issued by Clifford Mfg. Co., Waltham, Mass. The bulletin contains a wealth of up-to-the-minute data on bellows, including charts, diagrams, applications, detailed analysis of bellows' construction, materials, flexibility, filling medium, life. It also includes answers to such questions as: What common types of bellows and methods of attaching end fittings are available? Is stainless steel, nickel or brass the material most frequently used? What affects the choice of material? How can the flexibility be doubled and the spring rate of a bellows halved? How can the total pressure generated by a bellows be limited at a specified temperature? What are the advantages of a bellows shaft seal? What determines the motion relationship between two or more bellows when they are connected together? ..... Item 36

OIL VISCOSITY CONTROL

The Ray viscosity control system for its oil burners is described in an 8-page illustrated bulletin, Catalog F, issued by Ray Oil Burner Co., San Francisco, Calif. Design of the control valve in the system has been changed to use studs and nuts in place of the cap screws, so that the viscosity valve can be removed repeatedly without stripping the threads in the aluminum reservoir. Other changes in the system are also described in the booklet. ..... Item 37

DATA ON PLASTIC PIPE, TUBING

A series of five different 4-page, illustrated, multi-colored catalogs, has been issued by Carlon Products Corp., Cleveland, Ohio, and consisting of a general brochure and four booklets which cover its type E, EF, and T plastic pipe and its type C plastic tubing, respectively. The general brochure covers six types of flexible and rigid plastic pipe and tubing recommended for a wide variety of applications ranging from drainage and sewage handling to the transmission of hydrofluoric acid. Catalog E is devoted to the pipe recommended for use in coal mines, processing plants, and for low-pressure applications involving transmission of gases, highly corrosive vapor, and sewage. Catalog EF covers pipe for drinking water, food and chemical processing, and irrigation systems. Catalog T covers pipe for lawn sprinkler and drainage systems. Catalog C covers tubing for chemical and food processing installations. ..... Item 38

GAS TORCH CATALOG

Publication of a new catalog, Form ADC-702, on hand torches for gas welding and cutting, is announced by Air Reduction Sales Co., Div. of Air Reduction Co., Inc., New York N. Y. It is 36 pages, illustrated, and contains detailed information on Airco's complete line of welding and cutting torches, outfits, tips, and accessories. Extensive charts showing correlation of tip, mixer, extension and torch contain complete data for each component part. Cutaway views of the various parts of both welding and cutting torches, as well as welding and cutting pressure charts, make this catalog a valuable reference book. ..... Item 39

STEAM MIXER WATER HEATERS

Bulletin SM-41 entitled Packaged Water Heating, giving ratings and specifications for five sizes of its all-bronze steam mixer water heaters, has been issued by O'Brien Steam Specialty Co., Inc., Syracuse 2, N. Y. These heaters are packaged units, complete with all controls and accessories, which mix steam directly with water to provide instantaneous hot water at controlled temperature. Also described is the combination safety unit which supplies hot water at two or more controlled temperatures for industrial wash rooms and processes, and the steam-water mixers for small-capacity hot-water service. ..... Item 40

FURNACE FOR CELLARLESS HOUSES

A 4-page folder has been issued by Chimney-Furnace Corporation, Rockville, Md., and devoted to advantages of locating the furnace outside of basementless houses along the back wall instead of inside the house, and also describes the company's furnace designed for such applications. ..... Item 41

GAS-TIGHT ZIPPERS

Featured by a detailed description of installation procedures on eight-page publication No. 07753-NS on its pressure sealing zipper has been published by The B. F. Goodrich Co., Akron, Ohio. The pressure sealing zipper is an arrangement of overlapping rubber lips on slide fasteners which provides an effective and complete seal against gases and liquids ranging from zero pressure to the structural strength of the particular fastener used. Important in the publication are the detailed drawings showing the six styles in which the zippers are made and a discussion of the proper method of selecting the correct style number which should be used in particular applications. ..... Item 42

PUMPS FOR PROCESSES

A full line of pumps for handling corrosive and non-corrosive liquids, solids-carrying liquids and dry and semi-dry materials is described in a new condensed catalog issued by Yeomans Brothers Co., Chicago, Ill. The book, of 12 pages, is organized in sections: corrosive and non-corrosive liquids; solids-carrying liquids; and dry and semi-dry materials. ..... Item 43

BASEBOARD MANUAL AND CATALOG

A 16-page Radi-Vector (Vulcan baseboard) catalog No. 53 has been issued by The Vulcan Radiator Co., Hartford, Conn. It contains up-to-date technical information helpful in designing and installing baseboard systems. The catalog gives I-B-R ratings and pipe-sizing tables for use in designing systems in series; tables for 2-pipe steam systems, 2-pipe forced hot water systems, and 2-pipe gravity hot water systems. ..... Item 44

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REFRIGERATION VALVES

Catalog No. 100 standard size, 16 pages, has been issued by Henry Valve Company, Melrose Park, Ill., and covering its packless and packed valves, relief and check valves, strainers and driers and liquid level gages for refrigeration and air conditioning applications. The booklet is profusely illustrated and most comprehensive in dimensional and capacity information. ..... Item 45

DATA SHEET ON DUCT COATING

Application of thick protective coatings for tank and duct linings and for protection of equipment and floors is covered in Data Sheet C-42 on a new coating called Carbo-Kote 6020, issued by the Carboline Co., St. Louis 5, Mo. Due to a solids content of 100%, fluid and free flowing during applications, coatings can be applied .012 inch thick in one application even on vertical surfaces. Coating hardens at room temperature to a very hard protective film resistant to all acids except oxidizing types, and to practically all solvents and alkalis. Bulletin covers the process of applying the coating on steel and concrete, for which primer coats are required, and on wood, glass, carbon, porcelain, rubber and stoneware, for which no primer is required. ..... Item 46

DATA ON ACOUSTICAL TILE

A design data sheet describing Fiberglas Textured and Perforated Acoustical Tile has been published by Owens-Corning Fiberglas Corp., Toledo, Ohio. The eight-page publication, AC6.A1, includes data on the textured and perforated acoustical products, application methods by adhesive, mechanical suspension or clipping on wood furring strips and specifications. ..... Item 47

CHLORINE GAS METER

Bulletin 840-G27 has been issued by Builders - Providence, Inc., Providence, R. I., on its new model HCVS volumetric chlorinizer. This 4-page bulletin describes the high capacity visible flow chlorinizer which is designed to meter chlorine gas accurately at rates from 100 to 6,000 pounds per 24 hours.....Item 48

BLOWER WHEELS AND THEIR USE

Publication of a 48-page catalog, Torrington Airotor Blower Wheels, is announced by Torrington Mfg. Co., Torrington, Conn. It gives full specifications and performance charts on several new models and features the recently perfected coasting hub. There is also a complete packing data chart. The coasting hub, developed for manufacturers of pressure-atomizing oil burners, eliminates the troublesome after-fire problem which has been considerably intensified by today's use of harder-to-burn catalytic oils. It provides practically full air delivery during the first few seconds after pump and motor stop, so that shutdown is accomplished without soot, smoke, shudder, or carbonization at the nozzle. The catalog gives complete data for all sizes, so that user has a guide to proper use and selection of blower wheels. Detailed graphs showing performance as well as many other data.....Item 49

A PRIMER ON CONTROLS

An exceptionally readable and attractively prepared 20-page booklet entitled The Control Story has been published by Barber-Colman Co., Rockford, Ill. Profusely illustrated by simple illustrations treated in a light-hearted manner, the booklet classifies and defines the different types of controls concerned with temperatures, humidity and pressure and then proceeds to explain how both pneumatic and electric controls of different types operate. The booklet could easily be used in educational institutions as an introduction to the whole subject. Item 50

GUIDE FOR RESIDENTIAL VENTILATION

The Residential Ventilation Guide is a newly compiled 10-page booklet on mechanical ventilation in the residence. It is a development of the Attic Ventilation Code, which it supersedes. That subject is again fully treated in all of its new developments. A section is also devoted to the popular window fans. Three types of kitchen fans are in use, and the choice of the proper size, location, and proper precautions are covered. Growing residential uses for fans, such as bathroom, dark room and basement ventilation are discussed. Illustrations are used to clarify the various subjects and the language is not technical. Definitions, simple formulas, examples and a table of air changes are included. The booklet is designed for architects, builders, dealers and interested users. It is published by Propeller Fan Manufacturers' Association, Detroit, Mich. ..... Item 51

RUBBER-LINED PIPE

A 5-page folder No. 6907 on Manhattan rubber-lined pipe has been issued by Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J. The eight advantages of rubber-lined pipe together with recommendations, information on fittings and valves, as well as descriptive material relating to Condor flexible rubber pipe are included. Item 52

VENTING GAS APPLIANCES

A comprehensive, well illustrated booklet entitled Venting of Gas Appliances has been published by William Wallace Co., Belmont, Calif. Probably the most complete treatise on the subject now available, the manual deals with the basic requirements for proper venting of gas appliances. It was prepared from research material and field data collected over a period of time by the company from universities, independent laboratories, appliance manufacturers, and gas utility companies. Concisely written, the booklet should be of substantial assistance and benefit to all who install, maintain, and operate gas appliances. ..... Item 53

FLEXIBLE AND RIGID DUCTING

A 16-page catalog No. 503 on Airtron flexible and rigid Fiberglas ducting, hose, sleeves and couplings, is announced by Arrowhead Rubber Co., Div. of National Motor Bearing Co., Inc., Downey, Calif. The manual gives the complete story on this ducting material, including characteristics and performance specifications, and seven pages of engineering data which list data, working temperature ranges, design working pressures, leakage factors, and so on. Charts and graphs give the comparative characteristics of the more than 130 types and constructions available in the complete line and provides a graphic means of selecting the most suitable type, based on temperature and pressure requirements, for all types of air conditioning, heating, ventilating and conveying applications. ..... Item 54

RELIEF AND REDUCING VALVES

A condensed catalog, Bulletin 299, has been issued by A. W. Cash Valve Manufacturing Corp., Decatur, Ill., and devoted to the Cash-Acme automatic valves for pressure relief, pressure reducing and for controlling hot water heating systems. The bulletin, of 8 pages, gives comprehensive descriptions as well as application information on the other various valves. The last page includes condensed information designed to be of help to customer when ordering pressure reducing and regulating valves. Item 55

THERMOMETERS AND RECORDERS

Publication of four new measuring-instrument catalogs has been announced by Gotham Instruments, Division of American Machine and Metals, Inc., New York, N. Y. These Catalogs numbers 100, 200, 300, and 400 cover industrial thermometers, dial thermometers, indicating thermometers, and pressure gages and recorders, respectively. Catalog No. 500, to be published later will cover temperature controllers. Catalogs are complete in all descriptive details, clearly illustrated with photographs and diagrams, indexed for quick reference. Item 56

DATA ON ANODIC RODS

An 8-page standard size bulletin entitled The Elno Anodic Rod has been issued by The Cleveland Heater Co., Cleveland, Ohio. The bulletin, written in easily understood language and profusely illustrated, explains how rust is formed, how anodic rods prevent rust and illustrates the various types of Elno rods available for automatic heater, range boilers, electric water heaters, for general purposes, and for large hot water storage units. .....Item 57

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
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41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57			

Jan. H/51

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NEWS OF THE MONTH

ASHVE CONVENTION

and exposition to feature varied technical program and numerous new products.

"Man and His Relationship to Air" will be the subject of a symposium by scientists and engineers at the 1951 Annual Meeting of The American Society of Heating and Ventilating Engineers. Six sessions during which 17 papers will be given are listed on the technical program. The meeting will be held in Philadelphia, Jan. 22-25.

• **SUBJECTS.**—Topics to be covered include combustion studies on bituminous coal, fuel oil and smoke measurement, electrostatic precipitation, heat pump performance, snow melting, effective heat for steam heated structures, transportation heating and controls, solar radiation, axial flow fans, and panel heating and cooling.

The first session will be opened on Monday morning, Jan. 22, with ASHVE president Lester T. Avery, presiding. The report of the ASHVE Committee on Research will be given at the morning technical session the following day, by Robert C. Cross, chairman of the Committee. Among those who will participate in the symposium, which is scheduled for Wednesday, are Dr. Eugene F. DuBois, professor of physiology at Cornell University Medical College, New York, and medical director of the Russell Sage Institute of Pathology; Dr. Robert W. Keeton, head of the Department of Medicine, University of Illinois; and Charles S. Leopold, consulting engineer of Philadelphia. Nathaniel Glickman, assistant professor of medicine and research physiologist at the University of Illinois Medical School, will act as moderator. Morning technical sessions will be held at the Bellevue-Stratford, meeting headquarters, and afternoon sessions will be at Convention Hall, adjacent to the Commercial Museum, where the 10th International Heating and Ventilation Exposition will be held. Thus, it is hoped that many members who are engaged in activities of the Exposition will have an opportunity to attend some of the technical sessions.

The Exposition, opening on Monday, Jan. 22, and running concurrently with the meeting, will remain open one day longer, closing at 6:00 p.m. Friday, Jan. 26. All space has long since been taken and a wide variety of new products will be shown in what will be the largest display of heating, ventilating and air conditioning equipment ever held. Charles F. Roth is managing the show, and E. K. Stevens is associate manager.

• **PROGRAM.**—Registration of guests and members for the meeting will begin on Sunday, Jan. 21, at the Bellevue-Stratford Hotel. All plans for this, the 57th annual meeting of the ASHVE, are now complete, A. J. Nesbitt, general chairman of the Committee on Arrangements, announced. M. F. Blankin is honorary chairman of the Committee, and F. H. Buzzard, is vice chairman. Registration will be continued through Thursday. Information booths will be maintained at the Benjamin Franklin, Warwick and Penn-Sheraton Hotels, as well as the Bellevue-Stratford.

Serving as chairmen of the special committees for the meeting are: Program and papers, John James; banquet, M. E. Barnard; entertainment, E. K. Wagner; exposition, C. F. Dietz; finance, A. C. Caldwell; ladies, E. H. Dafter; publicity, W. P. Culbert; reception, J. O. Kirkbride; sessions, John Everetts, Jr.; and transportation, Isadore Director.

Technical Program

Monday, January 22, 9:30 a.m.

Losses from a Floor-Type Panel Heating System, by F. W. Hutchinson, D. L. Mills and L. J. LaTart.
Field Studies of Heat Losses from Concrete Floor Panels, by C. M. Humphreys, C. V. Franks and L. F. Schutrum.
Analysis of Air and Panel Cooling Systems, by Charles S. Leopold.

Tuesday, January 23, 9:30 a.m.

The Efficiency of Bituminous Coal-Burning Space Heaters, by J. W. Tieman and F. L. Bagby.
The Measurement of Smoke, by K. O. Beatty, Jr., and James E. Deas, Jr.
Report of Committee on Research by R. C. Cross, chairman.
Rating of Fuel Oils by a Test Unit, by D. W. Locklin and G. B. Parmelee.

Tuesday, January 23, 2:30 p.m.

A Survey of Electrostatic Precipitation, by E. A. Walker and J. E. Coolidge.
Theory of Earth Heat Exchangers for the Heat Pump, by L. R. Ingersoll, F. T. Adler, N. J. Plass and A. C. Ingersoll.
Factors Useful in Ground Grid Design for Heat Pumps, by George S. Smith.

Wednesday, January 24, 9:30 a.m.

Symposium—Man and His Relationship to Air—by Dr. Eugene F. DuBois, Dr. Robert W. Keeton and Charles S. Leopold. Nathaniel Glickman, moderator.

Wednesday, January 24, 2:00 p.m.

Operating Experience and Data from Sidewalk Snow-Melting System, by L. A. Stevens and G. D. Winans.
Principles of Effective Heat for Steam Heated Structures, by C. O. Mackey, N. R. Gay, R. D. Tutt, E. G. Powell and E. L. Broderick.
Heating and Thermostatic Controls in the Transportation Industry, by N. O. Kirkby.
Water-Vapor Permeability of Building Papers and Other Sheet Materials, by E. R. Bell, M. C. Seidl and N. T. Krueger (to be presented by title).

Thursday, January 25, 9:30 a.m.

Use of Aircraft Propellers for Axial Flow Fans, by E. C. Lundquist and M. J. Hamilton.
Roof Spray for Reduction in Transmitted Solar Radiation, by G. E. Sutton.
Solar Energy Transmittance of Figured Rolled Glass, by G. V. Parmelee and W. W. Aubele.

• **EXPOSITION.**—A wide variety of new products will be displayed at the Tenth International Heating & Ventilating Exposition in the Commercial Museum. Not only will this be the largest display of its kind ever held, but there will be many "firsts" among the exhibits, devices never shown before.

In the area of radiant heating, there are heated floors, ceilings, baseboards, wall panels and entire walls. The American Iron and Steel Institute's Committee on Steel Pipe Research will have a special display of radiant heating applications, and, incidentally, coupled with it, a demonstration of snow melting equipment.

A newsworthy development in the same connection is an addition to the growing number of baseboard type heaters, this one designed to replace the ordinary wooden baseboard. Carrying the same basic idea a step further, one of the largest producers of heating and ventilating equipment now offers a line of supplementary heaters especially for application around skylights and at points where there are unpreventable air leaks. This same exhibitor will have on view new lines of centrifugal and reciprocating compressors, centrifugal fans, gas unit heaters, louver cone and louver fin diffusers, and also a new line of projection unit heaters. One of these projection heaters is capable of throwing warm air a distance of 100 feet, according to the manufacturer.

• **FUEL.**—The question of fuel selection and methods of combustion and regulation of different fuels will be a dominating consideration at the exposition. Recent improvements in the design and construction of coal-burning furnaces and fire boxes have greatly widened the latitude of selection of coals. Changes in other directions have been of even greater effect in the development of heating equipment. The nation's nearly 153,000 miles of pipe lines for oil bespeak a far wider distribution and greatly increased use of oil for fuel, while the extension of gas pipe lines into the eastern territory has been a great stimulus to manufacturers of gas-burning equipment. Coincident with these developments has come a great increase in the use of bottled gas of the several common types, especially in small unit housing projects which have outrun public service facilities in many fast-growing communities.

• **AIR CONDITIONING.**—Complete air conditioning systems for winter and for both winter and summer service, will be thoroughly represented at the exposition. There will be extensive displays of the leading manufacturers with designs for every type of application, as well as the many specialists.

Typical of the larger and more complete exhibits will be that of one well-known manufacturer showing a centrifugal compressor, a complete line of Freon reciprocating compressors, a central station air conditioner, and evaporative condenser.

The central-station type of room air conditioner has been developed for multi-room applications, such as hotels, apartment houses, office buildings and hospitals. In point of service rendered, such systems operate exactly like independent room coolers, but they have the economic advantage of the central station operating principle. The system in question is designed primarily for water circulation, piped from a central source. Obviously, hot water is circulated during the heating season, and chilled water during the cooling season.

In addition to air conditioning systems for multi-room application, the exposition will feature many units and systems for industrial needs, such as provided the original inspiration for scientific air conditioning, and at present account for a very large proportion of the market for such equipment. One of the branches of the industry that has taken on a high degree of technical importance is air purification, including primarily filtration, but advancing into the difficult field of chemical and biological treatments. In this category is electrical precipitation, which has proved remarkably successful in many applications. One exhibit at the exposition will include an industrial low voltage precipitator, available for an inviting type of application in product or by-product recovery, but also useful for nuisance elimination, which is a remedy sought by industries that are literally in bad odor with the public. The exhibit in question will feature an exclusive built-in washing system, and will also emphasize packaged units of relatively small cost for installation on small jobs.

RADIANT HEAT

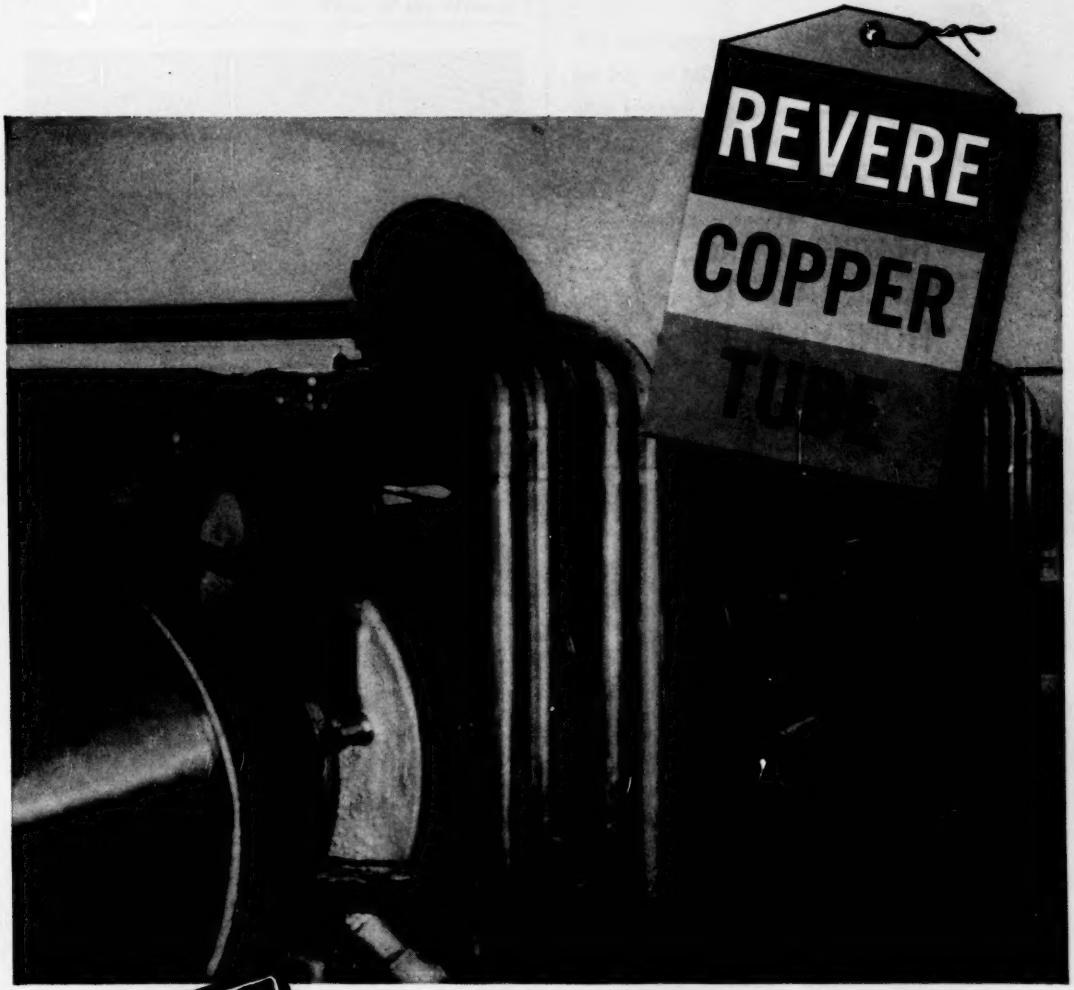
for air base residences will use nearly 100 miles of steel pipe.

Nearly 100 miles of steel pipe is being used to provide radiant heating systems in 256 modern ranch-type homes under construction at Westover Field Air Base, near Springfield, Mass. It is one of the most extensive installations of steel pipe ever undertaken for radiant heating of residences.

Westover Construction Corp. is building the project in four sections, each consisting of 64 ranch-type houses. When completed, the project will house 750 families of servicemen and employes at the air base. And this project is less than half the ultimate development anticipated.

• **ORGANIZATION.**—Schedules are set up for delivery of material to each of the four sections now under con-

Laying out and fabricating sections of coil over colored patterns on shed flood.



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Revere provides Copper Water Tube for use with solder or compression fittings; type B Copper Tube for installations requiring outside diameters of SPS pipe and brazed fittings; Red-Brass Pipe and Copper Pipe for use with threaded fittings. Every length of Revere pipe and tube is marked with the name Revere. Always look for this mark as your assurance of fine, uniform quality.

Revere pipe and tube are handled by leading distributors in all parts of the country. The Revere Technical Advisory Service is always glad to serve you.

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We doubt that you've worked on many igloos lately. We haven't helped heat any, either.

But we *can* help architects and their heating engineers provide the proper thermal environment for any client – anywhere – in any kind of structure.

We have a lot of literature on the automatic control of all phases of heating, ventilating and air conditioning. Information you should have in your files.

And we have a lot of very well informed engineers – in our 87 different offices – who have a lot *more* information right at their finger-tips.

We sincerely believe we can help you on any project that poses problems of control of any kind – for *control* is Honeywell's business.

So, why not *talk to Honeywell?* Why not *write* to Honeywell for complete information on the equipment discussed in the column across the page? And why not do it *now?*

MINNEAPOLIS **Honeywell**

First in Controls

Welding coil sections together in place.

struction as the building advances. Panels of steel pipe for radiant heating are partially prefabricated in a field shop set up under the roof of the last house on the project. When this last house of the 256 is ready for completion, there will no longer be any need for the fabricating shop. And Westover Construction Corp. expects to reach this point before next spring.

The installation of radiant heating systems has been organized thoroughly, down to the last detail of every phase. In each of the 64-house sections, 125,000 feet of steel pipe are being used. It is a special soft-bending steep pipe trade-named Jal-Duct, product of Jones & Laughlin Steel Corp.

• **SYSTEM.**—Drawings showed plans for systems in both the two-family and four-family houses which provide individual apartment heat control. Hot water for the systems is supplied by an Oakmont boiler with 115,000 Btu capacity in the two-family houses and by a Severn W-33 boiler with 165,000 Btu capacity in the four-family houses. The boilers are located in boiler room units outside the rear of the houses.

During cold weather, water in the boiler is maintained at 120F by oil heat. Heaters will be changed over to natural gas when it becomes available there next year. In each apartment a thermostat controls heat simply by turning a circulator on and off, which regulates the flow of water. The circulator is a Taco model which moves the water at a capacity rate of 12 to 15 gpm through 1-inch steel pipe coiled in the floors on 18-inch centers and on 12-inch centers around wall perimeters.

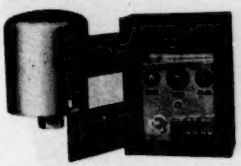
• **FABRICATION.**—To fabricate panels of coiled Jal-Duct pipe, the contractors set up a field shop so they can do most of the work before the pipe goes to the building site. Installation in the home foundation fits smoothly into the construction schedule between plumbers who precede them, and the concrete men who follow. The job goes quickly and fewer people are on the job location at one time.

A portable pipe bending machine with measuring jig bends the steel pipe 180 degrees to the correct

They won't help you heat igloos, but they will help you on many other problems of control— so write us now for these

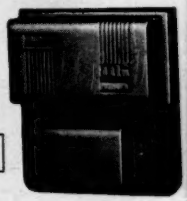
Facts you need—*FREE!*

Just check space opposite equipment you're interested in, fill in your name and address and mail this column to us. We'll get your facts to you promptly.



Weatherstat systems *tend to eliminate underheating and overheating.* These sensitive instruments compensate for such variable factors as sun, wind, air temperature, etc. Thus, they meter heat in direct proportion to need—*provide uniform comfort at lowest possible fuel cost.* Available in on-off, or modulating systems. Check here for 16-page booklet. ☐

Pin-point temperature control *in pneumatic systems* is now possible—thanks to this new Automatic-Reset Pneumatic Relay. Virtually eliminates offset, hunting and cycling in pneumatic systems. In comfort applications, guarantees maintenance of desired temperatures, even in severest or mildest weather. Check here for free folder. ☐



Hospital Thermostat *with "Nite-Glowing Dials"*—first thermostat ever designed specifically for hospital needs. Luminous dials glow in the dark and are easy to read without lights. No electrical connections required. Magnified indicators. New speed-set control knob, camouflaged against tampering. Simplified design eliminates frequent adjustment. Check here for 12-page booklet on hospital temperature control. ☐

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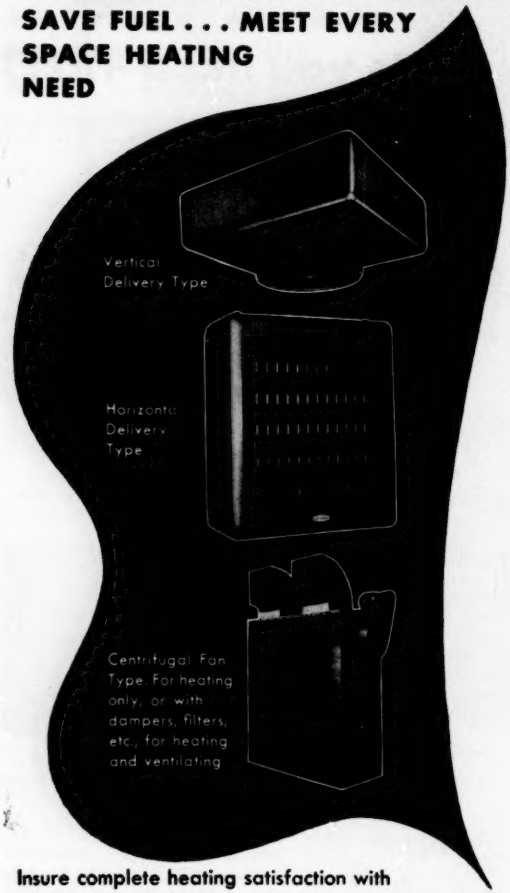
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WRITE FOR BULLETINS No. 1208A and 402

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radius in five seconds. As soon as formed, pipe lengths are positioned on the shop floor over painted patterns which correspond to the panel systems in each of the four types of houses. To avoid confusion, each system has been laid out in a different color paint. Coils are acetylene welded end to end, then they are stacked in order on a truck with special rig for hauling them to the job.

Arrival of the pipe coils is carefully timed. Concrete wall foundations have been set, plumbing installed, and the foundations filled with gravel, then a covering of sand. The sand is leveled 3½ to 4 inches below the level of the concrete wall, with only the plumbing terminals protruding above it. Over the sand a waterproof paper membrane is laid to hold out moisture from the concrete slab that will be poured. Insulating board is placed around the wall perimeter to prevent excessive slab edge losses.

The radiant heating coils are laid out over the paper and welders quickly complete the fabrication. The systems are tested with nitrogen at a pressure of 125 pounds for four hours. To date, no leaks have been detected, either in the pipe or in the welding.

As soon as the welders have completed their job, a wire reinforcing mesh is fastened together over the pipe, and the concrete slab is poured. During the pouring, each individual pipe in the radiant heating system is vibrated in the concrete to be sure that it is entirely encased. Sealed outside by the concrete and inside by water which remains in the system year-round, the steel pipe is practically rustproofed.

• **FINANCE.**—Family men in the service have long suffered from inadequate off-post housing. Under provisions of the Wherry-Spence Bill, National Housing Act, Title 8, 1949, private capital is being put to work providing thousands of new homes. Under a half-billion dollar fund the bill sets up, family housing, costing not more than $8,100 per unit for military and civilian personnel of the national military establishment, can be insured by FHA.

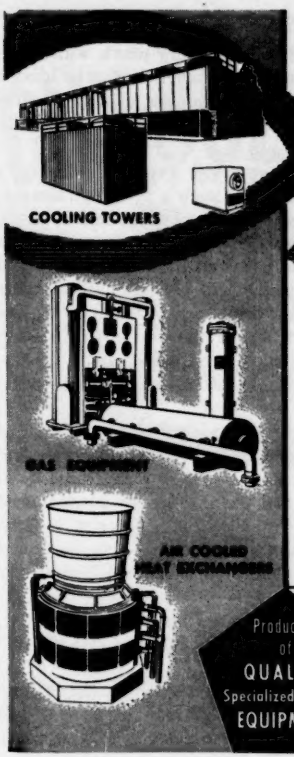
The Army, Navy and Air Forces have set up organizations to promote building under this program. Numerous projects are in various stages of completion. One of the largest and fastest progressing is the Westover project.

SKYSCRAPER AIR CONDITIONING

announced at Empire State Building. Tenants have choice of taking facilities; water-saving a feature of huge plant.

Award of a $1.5 million contract to Starrett Brothers & Eken, Inc., for the installation of a system to provide Empire State Building tenants with facilities for air conditioning, was announced December 10, 1950, by Lieutenant General H. A. Drum, president of Empire State, Inc.

Footings for steel structures to support cooling towers that will reach 100 ft above the street were poured behind the building's new off-street loading annex on



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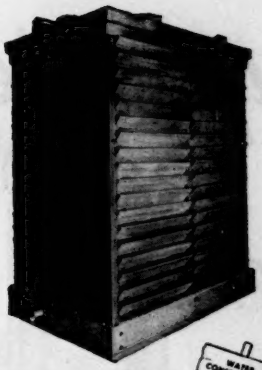
You'll Want to Specify *The* Pritchard "SRF" Tower!



Pritchard Series "SRF" Cooling Towers are especially designed for air conditioning and refrigeration installations requiring 3 to 24 tons capacity. California Redwood construction and steel pipe distribution system combine to assure long life and trouble-free performance. Materials are prefabricated before shipment . . . All bolts, nuts, washers and nails are furnished. Full instructions included for quick field assembly.

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The distinguishing feature of Mercoid Controls is the exclusive use of Mercoid hermetically sealed mercury switches. These switches are not subject to dust, dirt or corrosion, thereby assuring better performance and longer control life. The items shown below are but a few miscellaneous items. See Catalog No. 700 for the complete line.

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If you have a problem involving the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff — always at your service.

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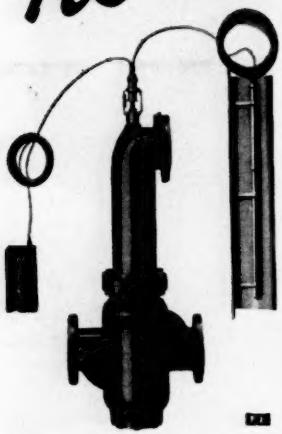

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Ask for new Bulletin ST-501 describing latest improvements.

19A

Sarcotherm

SARCOTHERM CONTROLS, INC. • Empire State Bldg. • NEW YORK 1, N. Y.

33rd Street. A chilled water cooling plant, which will occupy 4,0000 sq ft. will be installed in the building's sub-basement. A distribution piping system to provide chilled water to tenants will extend to the building's 86th floor.

• **OPTIONAL.** — "We have spent five years carefully surveying the possibilities of such a project," General Drum said. "We started with the premise that it would be unfair to force tenants to accept and pay for air conditioning if they did not want it. We finally worked out our new system, which will provide chilled water at reasonable rates for tenants who desire it. The tenants need only provide inexpensive units for converting the chilled water to conditioned air."

The system is expected to be installed and in operation by May 15.

• **ZONED.**—The chilled water piping system is divided into three zones to avoid excessive pressure developing at each of the tenant floors. The piping, varying in size up to 14 inches, and weighing over one hundred tons when filled with water, will be supported by special spring hangers that provide for expansion and contraction and avoid concentration of the load at any one point.

Plans call for installing pipes up to the 86th floor, but lack of time and current material shortages will make it possible for the building to supply chilled watter service to only its first and second zones in time for use during the summer of 1951. The service will eventually be made available to tenants in the upper stories of the building.

• **WATER SAVING.**—Conservation of city water is an important feature of Empire State's new water-chilling plant. Although the system will eventually process 5,000,000 gallons of water daily, the amount of water needed to make up for that lost by evaporation will equal the usual requirement of a small store 50 by 75 ft in size.

Water will be chilled to approximately 45F as it leaves the refrigeration equipment and is pumped up insulated pipes to a floor where it is to be used. Pipes will be installed in existing pipe shafts. Tie lines will connect the central pipes to tenants' air handling units.

Empire State's plant will employ the most advanced engineering techniques developed to date. The cooling towers have been designed to minimize the possibility of noise and fog in the surrounding areas.

The cooling plant, designed and built by York Corp., will ultimately develop 3,500 tons of refrigeration, requiring 4,500 hp to operate its heavy mechanical equipment. Motors as large as 700 hp will be used, and provisions are being made for the use of a 1000 hp unit for future installation.

Design of Empire State's system presented unusual problems, since there was no precedent for cooling a building of this height. New methods of installation and specially designed equipment were necessary to withstand hydrostatic pressure in excess of 600 pounds per square inch, resulting from columns of water almost one-quarter mile in height.

Installation of the chilled water distribution system has been planned so that tenants' space will not be

Grant Wilson

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- SAVES FUEL
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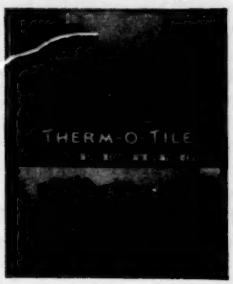

AMSTERDAM HOUSES

Two of New York City's recent jobs that we haven't had an opportunity to show, until now.

ABRAHAM LINCOLN HOUSES

All of these New York City housing projects have been large. Some of them have been outstandingly large. Should you want to read about a $30,000,000 project, for instance, turn back to our ad which appeared in the January 1949 issue of Heating, Piping & Air Conditioning. Therm-O-Tile Underground Steam Conduit was specified in ALL of the huge jobs we have named and shown here during the past 18 months.

Ask for a copy of Bulletin 381 which explains in detail why efficient and economical Therm-O-Tile is so consistently specified for important central heating projects.

H. W. Porter & Co., Inc. — Reid Hayden, Inc.

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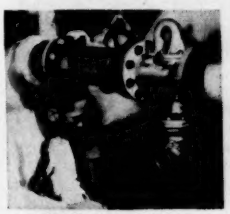

Shuntflo Steam Meter in leading aircraft plant.

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BUILDERS—PROVIDENCE

touched, despite the magnitude of the operation. Occupants of the building will be subject to a minimum of disturbance.

• **CREDITS.** — The Consolidated Edison Co. of New York, Inc., is providing new underground transformer capacity at the building to serve the large power requirements for the cooling plant.

The services of Edward E. Ashley were retained as consulting engineer for the project, with the office of Edwards & Hjorth retained as structural engineers.

Starrett Brothers & Eken, Inc., general contractors and builders, have employed Amirall & Co., Inc., to provide the mechanical work, with L. K. Comstock & Co., Inc., making the electric power wiring and switchgear installations.

ATOMIC PLANT HAZARDS

reduced by automatic control of temperature, humidity and air movement.

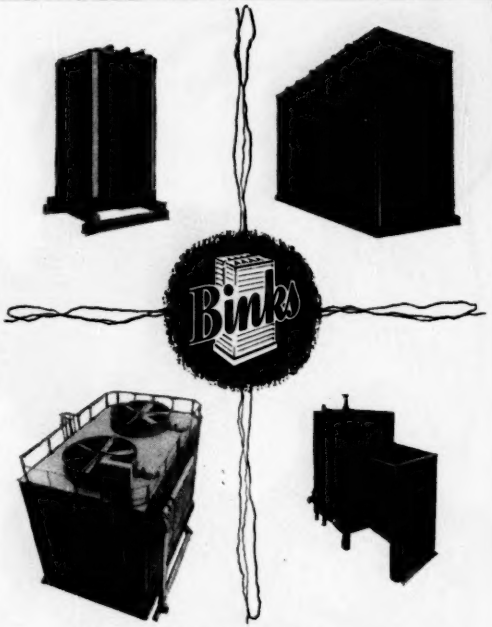
How automatic temperature, humidity, static pressure and air velocity controls are used to minimize the hazards in atomic energy plants was explained recently by J. A. Cutler, president of Johnson Service Company, Milwaukee, on the occasion of the awarding of contracts to make and install special automatic control systems for the fume hoods in Argonne National Laboratory near Chicago, and Hanford Engineer Works, Richland, Washington.

According to Mr. Cutler, there are currently three broad areas of application of automatic control apparatus in atomic energy plants. As an initial consideration, he said, plants where radioactive materials are handled almost always are equipped with complete air conditioning systems, and automatic temperature control apparatus is called upon to solve the same problems encountered in any first-class industrial building. Consequently, many thousands of standard regulators have been installed in these plants by Johnson engineers for operation in the the usual manner. However, many special considerations arise because of the hazards of atomic energy work.

• **AIR MOVEMENT.**—For instance, a second type of control application is specifically related to the presence of radioactive material, Mr. Cutler said. In most plants dealing with radioactive materials, this involves the precise control of the movement of air within each building to keep contamination at a minimum.

A typical building may have several zones of activity, each varying in its degree of exposure to radioactive materials, Mr. Cutler pointed out. General office areas, receiving and shipping rooms and maintenance areas are termed safe and may be said to comprise Zone 1. Zone 2 includes less safe areas where some process work involving radioactive materials is done. Zone 3, called a hot zone, includes all other areas of the building.

Unlike the problems of controlling ordinary air conditioning systems, however, it is necessary, with radioactivity present, to insure that the air always flows



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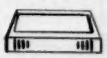

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from a safe zone to a less safe zone. The various zones are isolated from each other by walls, with traffic between zones having to pass through air locks.

• **PRESSURE.**—As an added safeguard, each zone is equipped with a comprehensive system of static pressure control. Zone 1 is maintained at the highest pressure; Zone 2, at the next highest pressure; and Zone 3, at the lowest pressure. Since there is always some leakage through the walls between zones, and also the possibility of someone leaving an air lock open, the static pressure control arrangement insures that any air flow will be from a safe to a less safe zone. Safety devices sound an alarm if air flows in the wrong direction.

• **FUME HOODS.**—Much of the space within a building handling radioactive materials may consist of hot-zone laboratories in which special fume hoods are installed for the treatment of materials. The use of these fume hoods, which are connected to exhaust ducts to provide a positive air movement to remove radioactive fumes and other toxic gases, has resulted in the development of the third and newest application of automatic control apparatus in atomic energy plants.

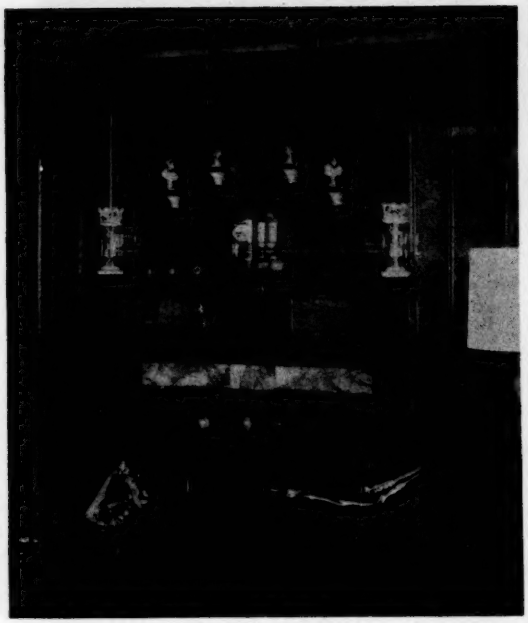
For safety, the velocity of the air through the hood door should be at least 125 fpm. However, if this velocity is above about 175 fpm, some radioactive particles undergoing processing are carried away. It is necessary, therefore, to control the velocity of air through the hood door between these limits. This problem is made more difficult because the hood door may be anywhere from wide open to almost completely closed and because of available resistance in the system when filters become dirty.

Recognizing the problem when fume hoods of this type were first proposed two years ago, Johnson engineers built a test installation, consisting of an exhaust system and two typical hoods, in its research laboratory. Exhaustive tests were conducted to develop a workable control arrangement.

Several means of detecting changes of velocity were tried, including vanes, hot wires, and pressure differences. The vane system was found to be unstable, while the hot wire method was influenced by air temperature as well as velocity. It has the further disadvantage of being unable to differentiate as to the direction of air flow.

• **PRESSURE DIFFERENCE METHOD.**—The pressure difference method of velocity control, which finally was adopted at Argonne and Hanford as a result of the Johnson tests, depends for its operation on the fact that the velocity of air, moving between two points, is proportional to the difference in pressure between these points. In the case of air moving at a velocity of 130 fpm, this pressure difference is .001 inch, water gage. To control the velocity at 130 fpm, within plus or minus 10 fpm, the control instrument must respond to infinitesimal pressure variation of .0001 inch w.g.

The successful regulation of contamination in atomic energy plants by means of these automatic control installations is an economy measure as well as a health measure, since expensive laboratory apparatus must be replaced if they become radioactive.



Perfect Air Control with Ornamental Outlets

For air circulating systems in residences the dual-unit Hendrick Bulator is ideal. It provides complete control of air throw and spread, with a decorative effect that actually adds to the attractiveness of the room.

The installation shown is in the home of the president of a prominent corporation. Although the deflecting vane grilles of the Bulator are directly behind the Gothic Cloverleaf design of the ornamental grilles, only the latter are visible from the room.

For Bulator dual-unit installations a wide variety of ornamental grille designs are available, so one can readily be selected to harmonize with the decorative scheme of any room.

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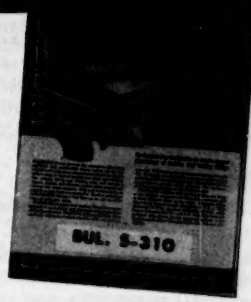

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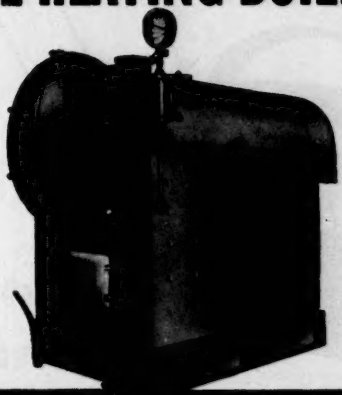

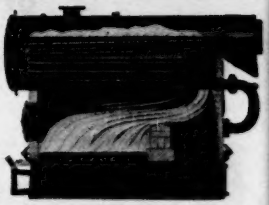

Cutaway view to show Type CC Compact Boiler (hand fired)

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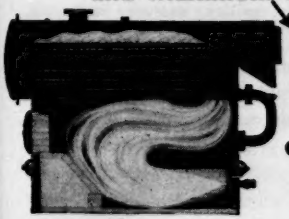
2. Large Furnace Volume
3. Large Disengaging Area
4. Large Steam Volume
5. Long Heat Travel

These Features Assure More Savings in Fuel and Maximum Heat Output



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Cutaway view to show Type CM Compact Boiler (mechanically fired)

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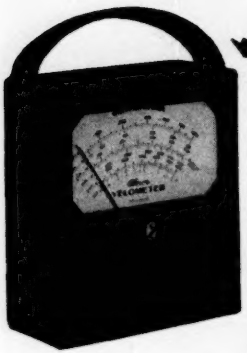

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PRECISION INSTRUMENTS FOR EVERY INDUSTRY

ASRE Convention

(Continued from page 85)

sibility of meeting the quality standards. An extensive program must be established and an educational program followed to instill quality mindedness in the workmen.

The authors covered the procedure that is employed at York to achieve quality control and they stressed that it is necessary to establish the same respect for quality control of room air conditioners that now exists in the case of household refrigerators.

Deodorizers

The use of activated carbon for air recovery was explained by John H. Bartol, W. B. Connor Engineering Corp., in his talk on Deodorizers and Their Application to Room Air Conditioners. While the application of air purification was confined to the 5-ton room air conditioner, he said that it could be used with other sizes. However, in the range below 3 tons, there is rarely the space needed to install the carbon tubes within the equipment.

Use of this type of deodorizer equipment, it is claimed, increases the cooling effect and insures a satisfactory volume of fresh air at all times, regardless of outside air damper setting. Constant purification of recirculated air prevents characteristic stale mustiness. Greater installation flexibility is provided for a room air conditioner without outside air intake, for it may be installed in any convenient place.

The problem in designing the necessary equipment was to expose the air stream to the proper amount of carbon and to have the equipment compact without imposing an excessive resistance to the air flow.

Ultraviolet Air Disinfection

Ultraviolet Air Disinfection in Room Air Conditioners was described by L. J. Buttolph, General Electric Co., Cleveland, Ohio.

An ultraviolet intensity of 5 milliwatts per square foot, effective throughout a cubic foot, will kill respiratory and E. coli test organisms at the same rate as they might otherwise be washed or diluted out of the same cubic foot of air by one air change per minute. This is a theoretical reduction of 62.3%. An additional air change or an additional 5 milliwatts per square foot can only dispose of 62.3% of the remaining 37.7% for a theoretical reduction of 82.5%. An average ultraviolet intensity of 5 milliwatts per square foot throughout the whole cubage of the room would theoretically provide the disinfection equivalent in the room of one air change per minute, such as has been suggested for crowded rooms.

Room air conditioners equipped with germicidal tubes can supply disinfected air equivalent to the sanitary ventilation tentatively suggested for rooms of average and low occupancy. They have value in more crowded rooms with ceilings so low (10 ft or less) that it is very difficult to provide ultraviolet intensities for upper air irradiation without objectionable reflected intensities in the lower and occupied part of the rooms.

Getting Personal

C. B. Rowe

C. B. Rowe *(Rating, Selection, and Use of Panel Type Air Filters,* page 58) is chief research engineer, Research Products Corp., Madison, Wisconsin. He is a naturalized citizen of Canadian birth. He graduated in mechanical engineering from the University of Wisconsin in 1942. After a brief interval of teaching mechanics in the University of Wisconsin Engineering School, he was employed by the Pratt & Whitney Aircraft Co. as a student engineer and later as a field service representative until he was made a layout draftsman on turbo-propeller engines. In 1946, Mr. Rowe became associated with Research Products Corp. as a research engineer and he has been chief research engineer since 1948. In his position, he is responsible for the development of air filters, evaporative cooler pads and products made from expanded sheet materials.

ABSTRACTS AND REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

BEACON BOILER REFERENCE BOOK

The second edition of the Beacon Boiler Reference Book has advanced to a second printing. This volume provides a comprehensive catalog and guide for obtaining the ratings and specifications of domestic heating boilers rated up to 2,000 sq ft of steam and equivalent hot water radiation. The first printing was available in January, 1950, and with the second printing there is a supplement to cover new and additional listings which have been announced since that time.

The first edition of this reference volume was published in 1940 as the first single book containing essential data on every low pressure heating boiler ever built. This reference book has been of great help to those seeking detailed information concerning such boilers.

Beacon Boiler Reference Book, second edition, second printing. Paper bound, 8⅜ x 11 inches, 206 pages. Published by Heating Publishers, Inc., 232 Madison Ave., New York 16, N. Y. Price, $3.

• • •

STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS —This compilation of ASTM Standards on Petroleum Products and Lubricants contains 125 ASTM standards, 112 test methods, 8 specifications, 3 lists of definitions, 2 tentative recommended practices for the purchase of oil used in transformers and oil circuit breakers. Also included are specifications for ASTM thermometers and a test method and standardization

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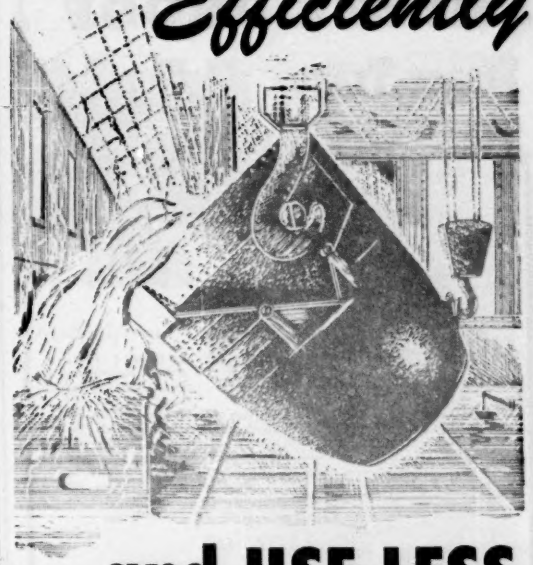

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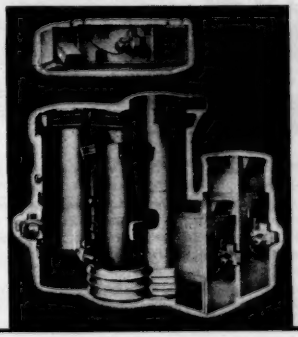

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Steam Traps
for Every Plant
Use

Because they drain completely when cold, these four types of Nicholson steam traps are positively freeze-proof. Can be freely installed outdoors. Universally recommended for use in lines which need not be in continuous use during cold weather, because they are freeze-proof and because their 2 to 6 times average drainage capacity results in minimum heat-up time. The non-air-binding feature of Nicholson traps also notably facilitates steam transfer in severe weather. Size ¼" to 2"; press. to 225 lbs.

BULLETIN 450

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...keeps **Western Rotary Turbine Ventilators** in operation, providing constant 'round-the-clock exhaust. Western's lifetime-guaranteed bearings are both mounted on the same axis...always stay in alignment...stand up to shipping jolts. Throat sizes from 6" through 48". The typical, clean, attractive silhouette that progressive industry demands. Western turbo-ventilation...high in efficiency, low in cost.

Request our catalogue for information, sizes, capacities, price lists. In 1950 Sweets and A.E.C. Jobbers are invited to participate in our national sales system.

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WESTERN ENGINEERING & MFG. CO.
1726-28 E. WASHINGTON BLVD., LOS ANGELES 21, CALIF.

of etched stem liquid-in-glass thermometers. Paper bound, 764 pages. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, $5.50.

PLASTICITY AND CREEP OF METALS—Special Technical Publication No. 107 has been issued to make available the four papers and discussions of a Symposium on Plasticity and Creep of Metals that was presented at a meeting of the American Society for Testing Materials held at San Francisco, Calif., October 10-14, 1949. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, $1.50.

BRASS TRIM FOR WATER CLOSET BOWLS—Effective December 15, there is a new standard for brass trim for water closet bowls, tanks and urinals. The standards include dimensions for screw threads for the spuds that are part of the vitreous china plumbing fixtures. It has been approved by the industry and is identified as Commercial Standard 172-50. Mimeographed copies are available. Commodity Standards Division, Office of Industry and Commerce, Washington 25, D. C.

PLUMBING—To guide the home owner in the selection of plumbing fixtures and related accessories and to give him an understanding of the water supply and waste disposal systems in a house, an illustrated 12-page bulletin by J. T. Lendrum, No. G50, has been made available. Small Homes Council, University of Illinois, Urbana, Ill.

BIBLIOGRAPHY ON SOLAR HEATING. — An annotated bibliography of about 150 references listing most of the important English and foreign papers published on the various aspects of solar heating between 1930 and the middle of 1950 is now available. Part I of ESL Bibliography No. 7 includes general and historical articles as well as papers on various industrial applications, such as utilization of solar energy for boilers; metallurgical furnaces; drying in the chemical, ceramic and food industries; electric power generation; refrigeration; distillation; etc. Part II is devoted to the important fields of solar heating of houses, the design and construction of solar-oriented houses, and the design, construction and use of domestic solar water heating devices. Engineering Societies Library, 29 West 39th Street, New York 18, N. Y. Price $2.

WHAT READERS SAY

Fire Fighting Equipment

EDITOR, HEATING AND VENTILATING:

The article in the Heating and Ventilating Reference Section entitled "Standpipes for Fighting Fires in Multi-Story Buildings," May, 1950, appears to be a very excellent presentation of its subject. There is, however, attached an appendix discussing various types of portable fire extinguishers. In describing the common soda-acid extinguisher, the article is seriously

in error. It states "The carbon dioxide, when carried out through a nozzle at the end of a flexible tube, mixes with the surrounding air and hinders or stops combustion."

I am sure that you realize that the extinguishing effect of this type of portable extinguisher is recognized by fire prevention engineers as being due to the quenching effect of the water which is discharged by the extinguisher. While there may be a little carbon dioxide in this water its effect as a fire extinguisher would be negligible. The purpose of mixing acid and sodium bicarbonate to produce carbon dioxide is simply to generate pressure to throw the stream of water.

R. L. Hunt

Washington, D. C.

Show Window Condensation

EDITOR, HEATING AND VENTILATING:

I have read with great interest the article, Moisture Condensation on Enclosed Show Windows by Theodore L. Gershun in the December, 1950, issue of HEATING AND VENTILATING. This article deals with a moisture problem which is one of the many new applications where package dehumidifiers may be used to advantage.

Mr. Gershun mentions two types of package dehumidifiers presently on the market which may be used to prevent moisture condensation on enclosed show windows; namely, the adsorbent type unit and the refrigerant type machine for moisture removal from the air.

These two type units are for a few applications competitive, but it is not always understood that each of the two type units has its definite psychrometric range where it is superior in moisture removal capacity and economy for comparable power input and cost of equipment.

As an average, usually the adsorbent unit is more economical at air temperatures below 65F and a relative humidity of 60%, and the refrigerant type used to best advantage at temperatures above 75F and relative humidities above 70%. In the intermediate range the two types become strictly competitive, but the adsorbent type has the advantage of being able to hold a lower dewpoint in the space to be dehumidified, provided it is kept tight against infiltration of outside air.

Mr. Gershun has shown how to calculate the moisture infiltration into the display area and has for his calculations assumed 72F DB and 35% RH inside the store as a winter comfort condition. Fifty F DB is assumed in the display area and the danger of condensation is studied when the outdoor temperature is —10F. The relative humidity should then be below 20% in the display area. Here is a typical example where only the adsorbent type unit will perform. The dehumidifier must produce air with a dewpoint below 14F to be of any value. A standard commercial package refrigerant type dehumidifier of the cost mentioned in the article cannot do effective work in this range as the evaporator coil would freeze up if the unit is placed in the display area, and if the unit is placed in the store the dehumidifier will not produce air of the required dry-

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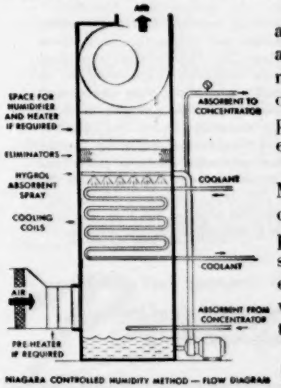

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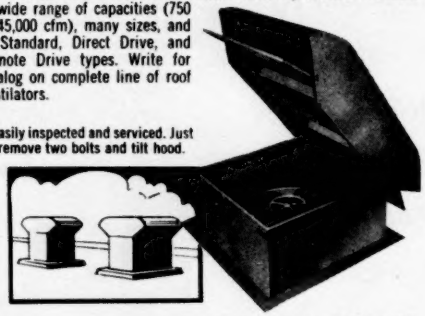

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ness of less than 11 grains per pound of air. A refrigerant type dehumidifier would, to remove the required amount of moisture at these conditions, have to be equipped with automatic means of defrosting the coils, but this cost is not shown in the cost analysis in Mr. Gershun's article.

The package dehumidifier industry is just stepping out of its child's shoes and it is not to be expected that people who do not generally deal with dehumidification problems should be familiar with the differences in operating ranges for equipment that has been on the market but for a few years.

Mr. Gershun's article has merit and he is to be congratulated for it.

Gunnar C. F. Asker,
Vice-President, Daly, Merritt & Sullivan, Inc.,
Desomatic Products Division
Washington, D. C.

Advertising to Engineers

EDITOR, HEATING AND VENTILATING:

With reference to the article on page 78 of the December, 1950, issue, "If I Were an Advertising Man," I wish to offer the following comments:

An engineer or designer is able to obtain a great deal of information regarding the properties and performance of materials from the many handbooks now in use; however, very few of these furnish engineering data which are related to the products to be purchased.

An engineer may wish to specify a tubular product to convey fluid, to act as a column, or to serve any other purpose in engineering design. He cannot do this unless he is familiar with the codes governing the installation, the specifications covering the materials to be used, and the latest design procedure and stresses permitted. These are all interrelated. Such information is too comprehensive and cannot be included in the advertising material which usually finds its way across an executive's desk, but it should be possible to suggest in such advertising matter that company publications are available containing the information described.

This company has over fifty publications devoted to the job of making design with tubular products, a straightforward procedure. The codes, specifications, design procedures and permissible stresses given have been gathered together over a period of years and revisions made as modernization of codes and specifications developed.

This has been accomplished to the satisfaction of the reader by reviewing the reports of field engineers regarding tubular product performance in the field and by constant review of the literature describing engineering installations in which tubular products are used.

Some of these publications describe the design of foundations using tubular piling, design of radiant heating systems, design of power plant piping, including design creep stresses for carbon and alloy steel piping and abstracts of the ASME Code. Design of oil, gas, and water lines, including quick methods of obtaining gas flow rates in transportation lines. Design of cylinders to the various code requirements.

These are but a few of the many types of information available in publications related to the products.

It is part of an advertising department function to see that publications of a technical nature, assembled at great cost, are distributed where they will be of greatest service, that is, in the engineering field. For this purpose they are referred to in the trade magazines from time to time and are available to engineers and designers, free of charge, upon request.

D. A. Evans
Supervising Engineer

National Tube Co.,
Pittsburgh, Pa.

INDUSTRIAL DEGREE-DAYS
November, 1950

City	55F Base	45F Base
Baltimore, Md.	256	91
Buffalo, N. Y.	489	240
Chicago, Ill.	552	289
Cleveland, Ohio	541	295
Detroit, Mich.	559	303
Indianapolis, Ind.	565	318
New York, N. Y.	261	84
Philadelphia, Pa.	264	89
Pittsburgh, Pa.	516	274
St. Louis, Mo.	487	244

Canadian Degree-Days for November, 1950*

City	November		Cumulative Sept. 1 to Nov. 30	
	1950	Normal	1950	Normal
Calgary, Alta.	1382	1122	2670	2276
Charlottetown, P.E.I.	705	858	1637	1619
Crescent Valley, B. C.	978	981	1949	2039
Edmonton, Alta.	1576	1215	2829	2406
Fort William, Ont.	1272	1143	2301	2219
Grande Prairie, Alta.	1785	1218	3062	2510
Halifax, N. S.	583	789	1380	1477
London, Ont.	930	843	1556	1477
Medicine Hat, Alta.	1230	1104	2195	1972
Moncton, N. B.	720	936	1718	1813
Montreal, P. Q.	814	948	1602	1689
North Bay, Ont.	1083	1017	2069	1975
Ottawa, Ont.	888	984	1754	1783
Penticton, B. C.	849	813	1593	1553
Porquis Junction, Ont.	1227	1266	2481	2462
Prince George, B. C.	1488	1068	2810	2253
Quebec City, P. Q.	843	1050	1752	1977
Regina, Sask.	1508	1355	2620	2557
St. John, N. B.	666	870	1616	1698
Saskatoon, Sask.	1542	1305	2698	2482
Toronto, Ont.	783	817	1322	1489
Vancouver, B. C.	688	657	1405	1350
Victoria, B. C.	630	462	1387	1172
Windsor, Ont.	873	795	1305	1274
Winnipeg, Man.	1395	1302	2300	2376

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

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Models 16" through 36" also have hinged housing for access to motor.

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COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

ASHVE MEETING—57th annual meeting of the American Society of Heating and Ventilating Engineers, at the Bellevue-Stratford, Philadelphia, Pa. A. V. Hutchinson, secretary of the Society, 51 Madison Ave., New York 10, N. Y. ..... **JANUARY 22-25, 1951.**

ASHVE EXPOSITION—10th International Heating and Ventilating Exposition under the auspices of the American Society of Heating and Ventilating Engineers, at the Commercial Museum, Philadelphia, Pa. Charles F. Roth, manager of the International Exposition Company, Grand Central Palace, New York 17, N. Y. ..... **JANUARY 22-26, 1951.**

IRON AND STEEL CONFERENCE — Two-day conference on Instrumentation for the Iron and Steel Industry, in Pittsburgh, Pa., sponsored by the Pittsburgh Section of the Instrument Society of America and the Carnegie Institute of Technology. L. M. Susany, general chairman, Carnegie Library, 4400 Forbes St., Pittsburgh, Pa. ..... **MARCH 28-29, 1951.**

ASME MEETING—Spring meeting of the American Society of Mechanical Engineers, at the Hotel Atlanta-Biltmore, Atlanta, Ga. C. E. Davies, secretary of the Society, 29 W. 39th St., New York, N. Y. ..... **APRIL 2-5, 1951.**

OIL HEAT EXPOSITION—19th National Oil Heat Exposition, at Navy Pier, in conjunction with the 28th annual convention of Oil-Heat Institute of America, at the Palmer House, Chicago, Ill. C. F. Curtin, secretary, 6 East 39th St., New York 16, N. Y. ..... **APRIL 2-6, 1951.**

POWER CONFERENCE—14th annual Midwest Power Conference, sponsored by Illinois Institute of Technology, at Hotel Sherman, Chicago. Conference director, Roland A. Budenholzer, at Illinois Tech, Technology Center, Chicago 16, Ill. ..... **APRIL 4-6, 1951.**

LUBRICATION SHOW — Annual convention and lubrication show of the American Society of Lubrication Engineers, at the Bellevue-Stratford Hotel, Philadelphia, Pa. W. F. Leonard, secretary of Society, 343 South Dearborn Street, Chicago 4, Ill. ..... **APRIL 16-18, 1951.**

FOUNDRYMEN'S CONVENTION—55th annual convention of the American Foundrymen's Society, in Buffalo, New York. William W. Maloney, secretary-treasurer of the Society, 616 S. Michigan Ave., Chicago 5, Ill. ..... **APRIL 23-26, 1951.**

REFRIGERATION MEETING—Annual meeting of the Refrigeration Equipment Manufacturers Association, at The Homestead, Hot Springs, Va. George E. Mills, public relations director, REMA, 1346 Connecticut Ave., N.W., Washington, D. C. ..... **APRIL 30—MAY 2, 1951.**

ARCHITECTS CONVENTION—1951 convention and national seminar meetings of The American Institute of Architects, at the Edgewater Beach Hotel, Chicago, Ill. Paul Gerhardt, Jr., chairman, 121 No. LaSalle St., Chicago, Ill. **MAY 8-11, 1951.**

ASRE MEETING—Spring meeting of the American Society of Refrigerating Engineers, at Hotel Statler, Detroit, Mich. M. C. Turpin, secretary, 40 West 40th St., New York 18, N. Y. ..... **MAY 27-30, 1951.**

NDHA MEETING—42nd annual meeting of the National District Heating Association, at the Statler Hotel, Detroit, Mich. John F. Collins, Jr., secretary-treasurer of the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. ..... **JUNE 5-8, 1951.**

INSTRUMENT CONFERENCE AND EXHIBIT—1951 Instrument conference and national exhibit of the Instrument Society of America, at the Coliseum, Houston, Tex. John McCaffery, assistant executive secretary of the Society, 921 Ridge Ave., Pittsburgh 12, Pa. ..... **SEPTEMBER 10-14, 1951.**

REFRIGERATION SHOW—7th All-Industry Refrigeration and Air Conditioning Exposition, at Navy Pier, Chicago, Ill. Show director, REMA, 1346 Connecticut Ave., N.W., Washington, D. C. ..... **NOVEMBER 5-9, 1951.**

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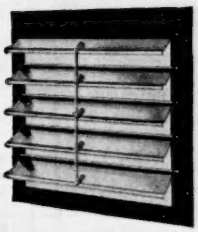

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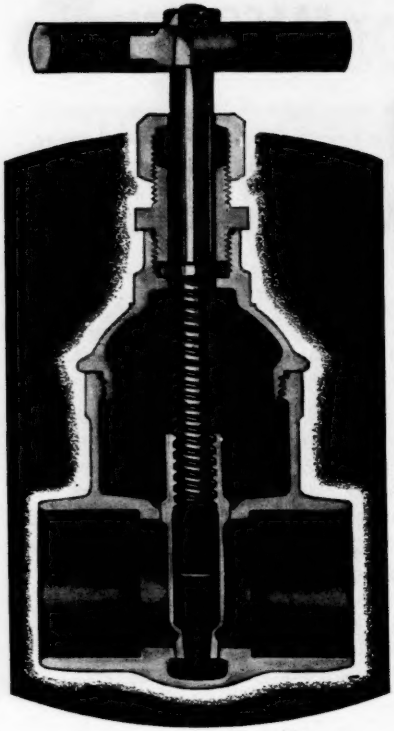

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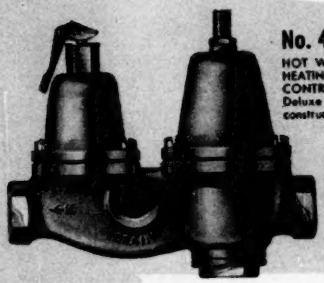

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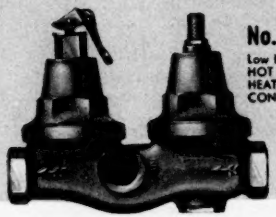

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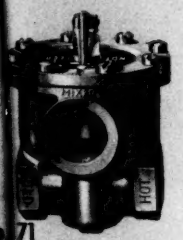

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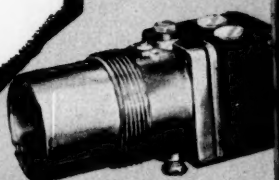

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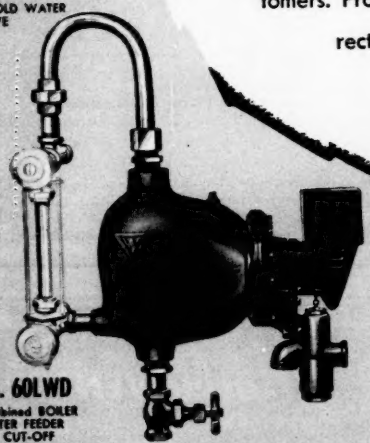

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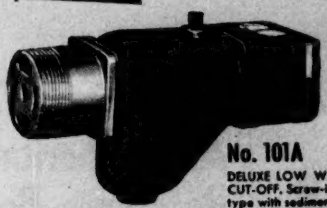

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Plumbing and Heating . . . SAFETY VALVES and CONTROLS

AIR CONDITIONING DESIGN CONDITIONS—INDUSTRIAL PLANTS

(Continued from last month's Reference Data)

Cosmetics

Manufacturing throughout the cosmetic industry is done at room temperatures of 65-70F with no humidity control. Often the windows are open to outside air. Although there is some dust control where powders are made, the practice is for the cosmetic companies to buy powders from the few companies that specialize in making them. In most of the cosmetic plants there is no regulation of dust. Bacteriological control is obtained by germicides used in the manufacture and included in the products.

Distilling

In the aging of whiskey in warehouses, the whiskey is stored in 50-gal charred oak barrels, in rooms with temperatures between 65-70F and 70-80% RH. Fermentation is carried on in enclosed tanks; heat generated during this process is carried off and the temperature controlled by heat exchangers.

Dust control is essential in the milling department where grain is received, ground and processed. Two methods are generally employed—the use of a fan to discharge the dust to filters; use of cyclone dust collectors.

Bacterial control is essential although the industry is converting to enclosed fermenters.

Electrical Manufacturing

A large number of products and processes are covered by the generic term electrical manufacturing. It includes not only coil winding, machine operations, assembling and testing, but a certain amount of laboratory work where specified conditions must be maintained.

In the room where refrigerator units are assembled, filtered air is supplied under positive pressure to keep out dirt from adjoining areas. Cooling is for comfort purposes only and no attempt is made to hold the relative humidity to any fixed amount. For performance testing of refrigerator units, definite air conditions are maintained. Although the air is filtered, no effort is made to hold the dust count to a special figure. In testing of refrigerator units, temperature and humidity control is employed for the return air.

In assembling lightning-arresters, the air conditioned room is maintained at the lowest possible relative humidity and temperature to reduce the dew-point.

The room where refrigerator valves are manufactured is held to as low a relative humidity as possible to prevent corrosion of valve steel.

The amount of rejects of coil and high tension transformer windings for electronic work has been definitely reduced as the result of keeping moisture content and dust out of the windings.

Maintenance of constant temperature is a primary consideration to insure uniform calibration of thermal circuit breakers.

Humidity is held down to prevent rusting during the internal assembly of electronic tubes and in the lapping operation listed in Table 6.

TABLE 6—ELECTRICAL MANUFACTURING

Room or Process	Temperature, F	Relative Humidity, %
Engineering, drafting, and color laboratories	73	45-55
Manufacturing	70 ± 1½	Comfort
Laboratory	70 ± 1½	Comfort
Electronic and X-ray		
Coil winding and high tension transformer winding	72	55
Assembly of tubes	68	35
Refrigeration		
Manufacture of refrigeration valves	75	40
Assembly of refrigerators	75	
Testing	65 and 82	47 ± 5
Testing refrigeration units in traveling, electrified chain conveyors	65 and 82	47 ± 5
Spray painting	75	—
Transistor assembly and calibration	76 ± 1½	Comfort
Multiplying and wrapping cotton and glass yarns on copper conductors	75	65-70
Small mechanisms—assembly to clock telescopes	72	45-55
Assembly of lightning-arresters	68	25-45
Thermal circuit breaker — assembly and test	76 ± 1½	30-50
Lapping of thrust runners for vertical water wheel governors	70	Under 50
Meters—assembling and testing	74-76	40-45
Switchgear		
Winding of capacitor sections, storage of paper, assembly of foam and cutouts	72	50
Rectifiers—processing selenium and copper oxide plates	74 ± 2	30-40

Fur Storage

Members of the Certified Cold Fur Storage Association have reached the conclusion that the very best method of storing furs in a vault is to maintain temperature at 40F or lower, and the relative humidity from 50-65%. In fact, the American Institute of Refrigeration will not certify a vault as being a cold storage vault unless it can maintain a temperature of 40F in the vault.

Many members of this association store furs just below freezing, chiefly because they store in a wholesale way for many retail stores. Since the price for storage is based on the quantity of furs stored, it is not economical for the storer to inspect the fur. The below-freezing temperature is depended on to prevent any moth eggs or larvae, with which the fur may be infested, from hatching or becoming active.

A shock system for eradication of any insect infestations is also used. This treatment consists of dropping the temperature to 12 or 20F, then raising it to 60 or 70F before the temperature is lowered to 40F.

which is the holding temperature. While in the north only one shock treatment is given during a storage season, southern fur storers may employ this system once or twice a season.

Glass and Glass Yarn

In the manufacture of laminated or safety glass, a sheet of plastic is used as a filler or binder between two sheets of glass. It is important that the two pieces of glass be dust-free to produce a clear product, and that the plastic binder be properly dried to remove intercellular moisture.

The plastic (vinyl resin) is slightly hygroscopic under humid conditions so that it may take up enough moisture to prevent it serving as a satisfactory binder for the glass sheets. At ordinary room temperature it is limp and tacky but at temperatures below 65F it becomes fairly stiff and it loses its stickiness.

Air conditions to be maintained in this industry are listed in Table 7.

All air supplied to the dehumidifier serving the cutting room is double filtered to protect the alumina beds from contamination.

Glass coolers on each assembly conveyor cool the glass from 110F, the temperature as it leaves the washers, to 60F as it enters the laminating room. It is important to keep the air in the cooler at low humidity to pick up any surface moisture that may remain on the glass from the washer, and to prevent condensation on the cooling coils.

Fusing in the manufacture of optical lenses is carried out under air conditions of 75F and 45% R. H. Electrostatic filters are used to hold down the dust count.

In the manufacture of fiber glass strands which form the basis of fiber glass yarn, small glass marbles are melted in an electric furnace. Diameter of filaments produced are controlled by the temperature of the molten glass and the speed at which the filaments are drawn.

The very fine filaments are passed through a spray of a special lubricant and then through a metal V-shaped notch that draws the fibers into a single strand. The lubricant oils the filaments and serves as a temporary binder to make the filaments adhere to each other in subsequent fabricating processes. The single strand that is formed is drawn to a high speed winder. These strands are so fine that at least two strands are twisted together to form a thread suitable for weaving. The strands are twisted to form yarn which is then wound on cones for shipping.

Where the continuous filaments are produced, it is necessary to maintain a temperature of about 75F and a relative humidity of 65% to prevent the lubricant from drying too rapidly. It is also necessary to pass large amounts of air through this room to carry away the heat given off by the electric furnaces. Temperature on the electric furnace floor is about 85F.

TABLE 7—AIR CONDITIONS FOR LAMINATED GLASS MANUFACTURE

Room or Process	Temperature, F	Relative Humidity, %
Cutting room	65	15
Vinyl inspection and laminating room	55	15
Vinyl drying ovens	142	5

Laundry and Dry Cleaning

In laundry work, the problem is to make conditions as comfortable for the workers as possible. The most important phase of the laundry industry is dry cleaning which is conducted under conditions of 65-70F and 65% R.H. At present, there is a tendency to filter the air supplied to the drying rooms instead of the air supplied to drying tumblers. Bacterial control is not considered necessary. In rooms used for drying, after rugs have been washed, air is maintained at 175-180F and 35-40% R.H.

Leather

For drying heavy leather, such as vegetable-tanned sole leather, the tanned hides are hung in an atmosphere having a temperature of about 70F, with 75% relative humidity. Over a period of ten days or so, these conditions are changed to 90F, with a relative humidity of 35% or less. While these conditions are not closely controlled and they may vary greatly in different tanneries, a difference of 10 units in these figures would not be surprising. Control largely depends on the judgment of a skilled operator.

Most light leathers, such as chrome-tanned shoe upper leathers, are dried under more closely controlled conditions in a drying tunnel. A typical set-up calls for 120F and 45% R. H.

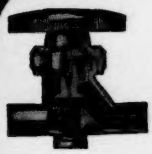
Leather is sometimes moistened to prepare it for rolling or stretching in manufacturing operations. This is usually done by dipping or spraying with water until the required weight of water is absorbed. Then the leather is allowed to stand in an atmosphere at room temperature or slightly higher and with a relative humidity of 95% for a period long enough to permit the water to become properly distributed throughout the leather. In some shoemaking operations, part of the shoe may be moistened by spraying with steam.

Leather is usually stored in warehouses without temperature or humidity control. However, it is necessary to keep the relative humidity below 85% to avoid mildew. For long time storage, 50-60F and 40-60% R. H. would be considered desirable.

No special control of dust is followed through in the industry.

Until 1948, laboratories for physical testing of leather were maintained at 70F and 65% R. H. These conditions are now being changed to the new standard which is 73.4F and 50% R. H.

(To be continued)



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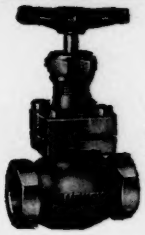
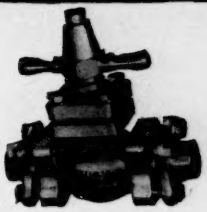
With balanced-action



AMMONIA VALVE
Bolted Bonnet — screw or flanged connections. Also with screwed bonnet, sizes 1" and under

WING CAP VALVE
Non-ferrous



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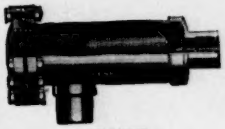

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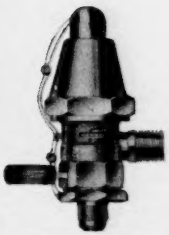
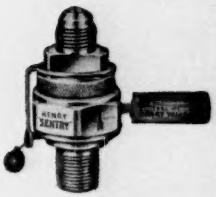
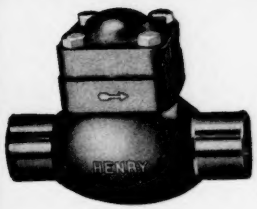


SUPER DIAPHRAGM RELIEF VALVE
With Built-in Replaceable Rupture Disc Cartridge in Outlet Port

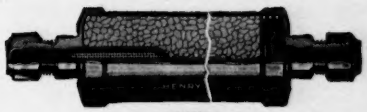


OVER-PRESSURE UNLOADER
With Replaceable Rupture Disc Cartridge



CHECK VALVE
Piston Type For Freon

DRIER
Cartridge type with dispersion tube



DRIER
Brass shell with dispersion tube and compression spring

OVER-PRESSURE UNLOADERS, RUPTURE PLUG TYPE

A RUPTURE PLUG
Venting To Room Atmosphere "Throw-Away" Type

A RUPTURE PLUG
With Flare Outlet Connection For Venting To Outside Atmosphere. "Throw-Away" Type

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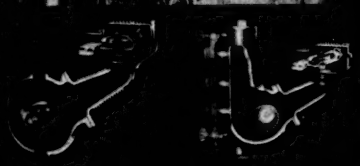
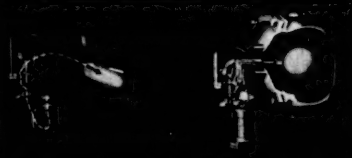


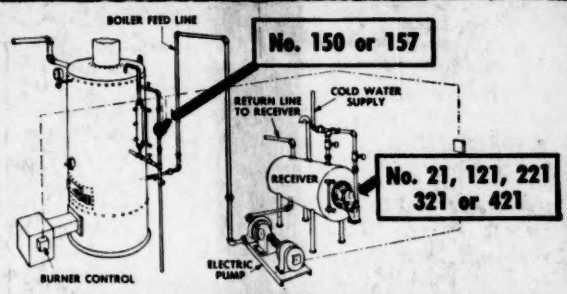
Pump controllers

Highly perfected and proved in thousands of installations, the McDonnell No. 150 is the pump control for boilers with steam pressures up to 150 lbs. Convenient terminals provide circuits for pump motor (or starter), for low water cut-off of burner, and, when desired, for low water alarm. No. 157 (at right) is the same dependable control with integral water column which greatly cuts cost of installation under many conditions.



Receiver tank make-up feeders

To provide make-up water when insufficient condensate is returned to the tank, dependable McDonnell make-up feeders are available. Simplest form when adaptable is the No. 21 series (at left) which is installed right in receiver tank and feeds water directly. Four flange shapes and sizes are provided in this series (Nos. 21-121-221-321) to fit openings in most tanks. The No. 421 (at right) takes care of conditions where installation with equalizing piping is necessary. These quality feeders seat drip-tight against high water pressures.



—but no need to SCRAM with dependable boiler water level control

A steam boiler without automatic boiler water level control is strictly a "Sam-you-better-scram" deal. But there's no need to scram when the job of safeguarding the boiler is taken over by the simple hook-up diagramed above.

It will pay you to study this diagram for a moment and note how the water level (the feed pump) is controlled from the water level itself by a McDonnell No. 150 or 157 pump control. This modern method holds the water level within the close limits that steps up efficiency . . . pays for the control.

An extra switch on the control provides circuits for low water fuel cut-off and low water alarm if a fuse should blow in the feed-pump circuit. The McDonnell make-up feeder on the receiver tank maintains a minimum level in the receiver tank at all times.

Note the facts opposite about the dependable McDonnell equipment that will give you this protection and increased efficiency. Ask for data sheets covering every detail of the simple installation and wiring.

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